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# CONTENTS

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# SYNTHESIS, STRUCTURE, AND PROPERTIES OF A COMPLEX COMPOUND BASED ON Mn(II) CHLORIDE AND POTASSIUM KETOPROFEN

**Rustamov Temur**
*PhD student the Khorezm Mamun academy*
temur1998@gmail.com

**Azizjanov Khushnud**
*Associate Professor, Urgench State University*
hushnud@mail.ru

**Abdullaeva Zubayda**
*Associate Professor, Urgench Technological University RANCH*
zubayda.abdullayeva.91@mail.ru

**Khudoyberganov Oybek**
*Senior researcher of Khorezm Mamun academy*
oybek_hudoyberganov@mail.ru

**Annotatsiya.** Ushbu ishda marganes (II) xlorid va ketoprofenning kaliyli tuzi asosida yangi kompleks birikma sintez qilingan. Dastlabki reagentlar 1:4 mol nisbatda olindi va kompleks hosil bo‘lishi o‘rganildi. Olingan birikmaning tarkibi, tuzilishi va xossalarini aniqlash uchun element tahlili, infraqizil (IQ) spektroskopiya, rentgenfazaviy tahlil va termik tahlil usullaridan foydalanilgan. Tahlil natijalari asosida markaziy Mn (II) atomining koordinatsion soni 6 ga teng ekanligi aniqlandi. Olingan natijalar marganes komplekslarining tuzilishi va xossalarini yanada chuqurroq o‘rganish uchun asos bo‘lib xizmat qiladi.

***Kalit so‘zlar:*** *marganes (II) xlorid, ketoprofen, kompleks birikma, sintez, infraqizil spektroskopiya, rentgenfazaviy tahlil, element tahlil, termik tahlil, koordinatsion son.*

**Аннотация.** В данной работе синтезировано новое комплексное соединение на основе хлорида марганца (II) и калиевой соли кетопрофена. Исходные реагенты брали в мольном соотношении 1:4 и изучали образование комплекса. Для определения состава, структуры и свойств полученного соединения использовались методы элементного анализа, инфракрасной (ИК) спектроскопии, рентгенофазового анализа и термического анализа. По результатам анализа установлено, что координационное число центрального атома Mn (II) равно 6. Полученные результаты служат основой для более глубокого изучения структуры и свойств комплексов марганца.

***Ключевые слова:*** *хлорид марганца (II), кетопрофен, комплексное соединение, синтез, инфракрасная спектроскопия, рентгенофазовый анализ, элементный анализ, термический анализ, координационное число.*

**Abstract.** In this work, a new complex compound was synthesized based on manganese (II) chloride and the potassium salt of ketoprofen. The initial reagents were taken in a molar ratio of 1:4 and the formation of the complex was studied. To determine the composition, structure, and properties of the obtained compound, methods of elemental analysis, infrared (IR) spectroscopy, X-ray phase analysis, and thermal analysis were used. Based on the analysis results, it was established that the coordination number of the central Mn (II) atom is 6. The obtained results serve as a basis for a more in-depth study of the structure and properties of manganese complexes.

***Keywords:*** *manganese (II) chloride, ketoprofen, complex compound, synthesis, infrared spectroscopy, X-ray phase analysis, elemental analysis, thermal analysis, coordination number.*

## Introduction

Non-steroidal anti-inflammatory drugs are widely used in the treatment of inflammatory diseases, and their mechanism of action is mainly related to the inhibition of the cyclooxygenase-2 (COG-2) enzyme. Experimental and epidemiological studies have shown that nonsteroidal agents are of great importance in the prevention of colon cancer [1-3]. Their anti-tumor or anti-cancer pharmacological effect is likely due to their suppression of cyclooxygenase-2 production in the body, as the prostaglandins they produce can enhance tumor invasiveness, angiogenesis, and cancer development [4-7]. Inhibition of COG-2 can stop carcinogenesis, prevent the development of cancer, and reverse advanced cancer.

However, there is no direct correlation between the inhibitory power of COG-2 and the anti-tumor effect of nonsteroidal substances. Analogs obtained from some COG-2 inhibitors, but not possessing COG-2 inhibition, also continue to exert a strong antitumor effect. Although the mechanism of anti-tumor action of COG-2 inhibitors remains controversial to this day, some non-steroidal drugs have been evaluated in preclinical and clinical studies as anti-tumor drugs either independently or in combination with other chemotherapeutic agents.

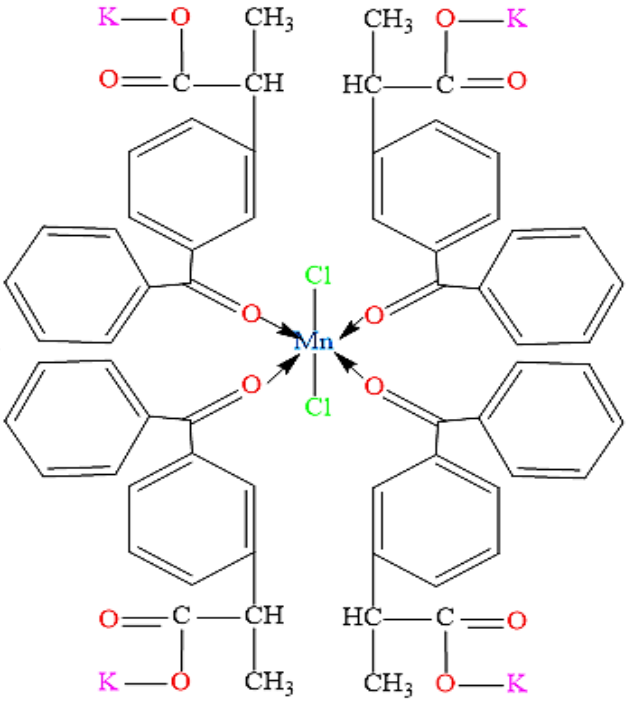
Manganese (II) ions can form various complex compounds with organic ligands. Their structure and properties play an important role in various biological and pharmaceutical processes. Ketoprofen is a non-steroidal anti-inflammatory drug whose complexes with metal ions occupy an important place in terms of pharmacological activity. In this work, a complex based on Mn (II) chloride and ketoprofen was synthesized and its properties were investigated.

## Research Methodology

The following reagents were used in the synthesis process: manganese (II) chloride tetrahydrate ($MnCl_2 \cdot 4H_2O$), ketoprofen ($C_{16}H_{14}O_3$), potassium hydroxide, ethanol, distilled water.

1. $HKet + KOH = KKet + H_2O$

2. $MnCl_2 + 4KKet \rightarrow$




Complex synthesis: 0.04 mol of ketoprofen solution in 20 ml of ethanol was poured over with 0.004 mol of KOH solution and ketoprofen potassium salt was obtained [8]. In another vessel, 0.01 mol of manganese (II) chloride tetrahydrate was dissolved in 20 ml of water. Both solutions were mixed, and their composition was reduced to a slightly alkaline environment. This mixture was reacted at a temperature of 50 °C for 3-4 hours in a magnetic stirrer. The resulting precipitate was filtered and washed with ethanol. The resulting solid substance was dried at room temperature [9]. The output of products was 79%.

Elemental analysis was conducted to determine the composition of the synthesized complex compound. The obtained research results were compared with the theoretically calculated ones (Table 1).

**Table 1.** Elemental analysis of synthesized compounds.

| | KKet | | $K_4[MnCl_2(Ket)_4]$ | |
|---|---|---|---|---|
| | Calculated | Found | Calculated | Found |
| K | 13.35 | 13.33 | 12.05 | 12.03 |
| Mn | - | - | 4.25 | 4.21 |
| C | 65.75 | 65.79 | 59.35 | 59.29 |
| Cl | - | - | 5.48 | 5.42 |
| O | 16.44 | 16.49 | 14.84 | 14.92 |
| Gross formula | $C_{16}H_{13}O_3K$ | | $MnK_4C_{64}O_{12}H_{52}Cl_2$ | |

## Analysis and Results

To determine the structure of the synthesized complex compound, the IR spectra of potassium ketoprofen and the complex compound were compared, and changes in the main functional groups were analyzed. Ketoprofen is an organic substance whose main functional groups are carbonyl (C=O, carboxylate group, and ketone), OH (carboxylate group), aromatic C=C, C-H and main peaks 3441-3038 $cm^{-1}$ OH deformation (carboxylate group), 1737 $cm^{-1}$ ketone (C=O), 1697-1608 $cm^{-1}$ carboxylate (COOH) and aromatic C=C, 1460-1387 $cm^{-1}$ $CH_3$ and $CH_2$, 1161-1040 $cm^{-1}$ C-O deformation [10-12] (carboxylate group) (see in Figure 1(a)).

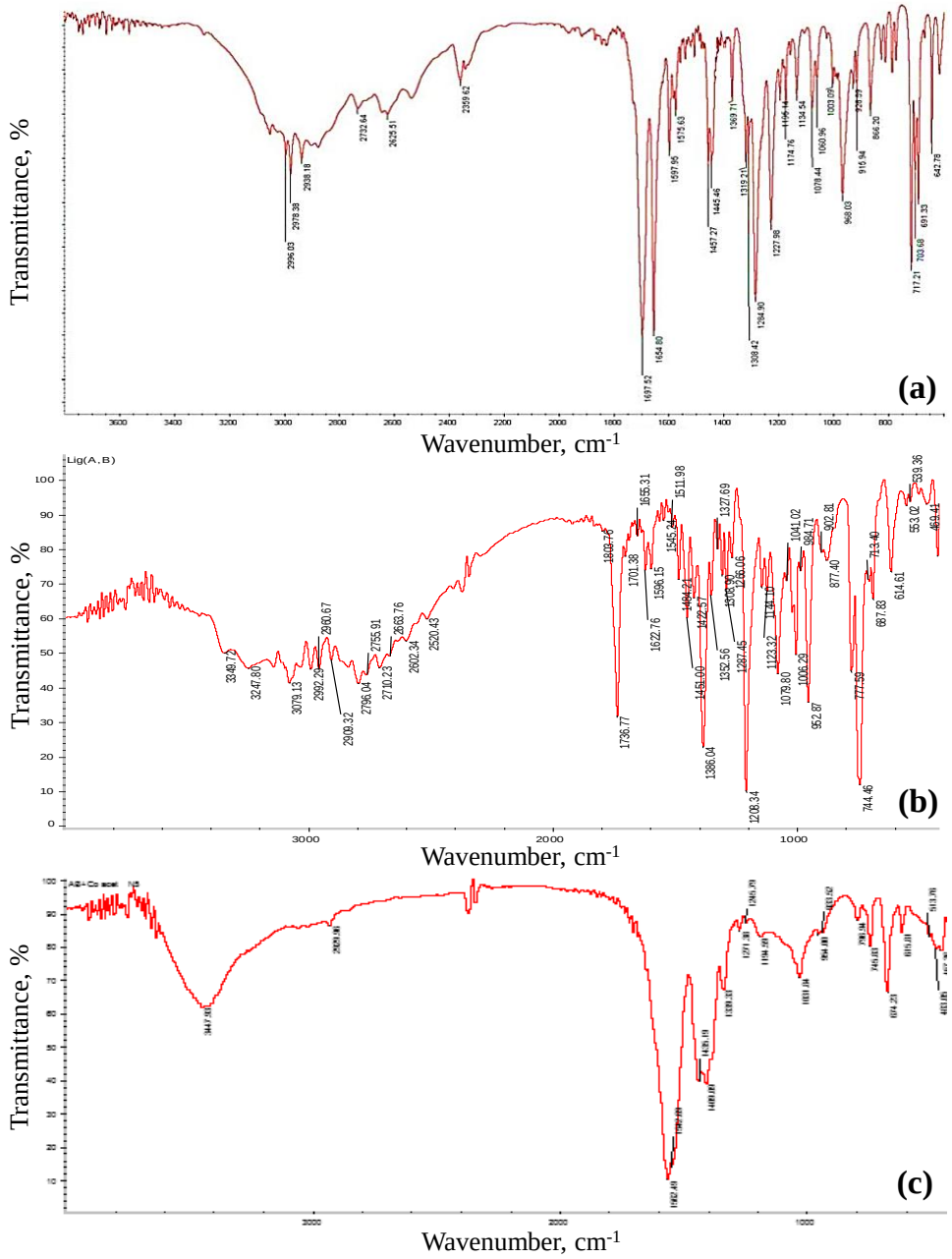



**Figure 1.** IR spectra of ketoprofen (a), potassium ketoprofen (b), and complex compounds (c).

The main vibrational frequencies in the infrared (IR) spectrum of potassium ketoprofen are: 1701 and 1655 $cm^{-1}$ - carbonic stretching vibrations of the ketone group, 1545

$cm^{-1}$ - asymmetric carboxylate vibration, and 1422 - 1386 $cm^{-1}$ - symmetric carboxylate vibrations. These frequencies play an important role in determining the functional groups of potassium ketoprofen and assessing their interaction with metal ions (as given in Figure 1 (b)).

The main changes in the IR spectrum of the synthesized complex compound are: the deformation vibration frequency of OH (3441 $cm^{-1}$) decreased or disappeared. The formation of new lines in the range of 250-350 $cm^{-1}$ indicates Mn-Cl bonding. This is confirmed by deprotonation and complex formation. The ketone peak (C=O) shifted from 1737 $cm^{-1}$ to 1723 $cm^{-1}$. This indicates a spectral change in ketoprofen under the influence of coordination. The difference ($\Delta\nu$) between the asymmetric and symmetric frequencies of COO− (1619 $cm^{-1}$ and 1184 $cm^{-1}$) allows us to determine the type of metal-ligand bond. New peaks appeared in the range of 500-600 $cm^{-1}$. This indicates the formation of Mn-O bonds. While ketoprofen is in a free state, OH and carbonyl groups (COOH, C=O) have distinct spectral peaks (see in Figure 1(c)). In the IR spectra of potassium ketoprofen and complex compounds, the intensity of these peaks is significantly reduced. The type of bond can be determined by $\Delta\nu$ ($\nu_{as}$ - $\nu_s$): If $\Delta\nu > 200$ $cm^{-1}$, then it is a monodentate coordination; if $\Delta\nu < 200$ $cm^{-1}$, potassium ketoprofen forms a bidentate or bridge compound with manganese (II) chloride [13].

Oscillation of asymmetric stretching ($\nu_{as}$ COO−): ≈ 1619 $cm^{-1}$

Oscillation of symmetrical stretching ($\nu_s$ COO−): ≈ 1184 $cm^{-1}$

$\Delta\nu = \nu_{as} - \nu_s = 1619 - 1184 = 235$ $cm^{-1}$.

In our calculations, $\Delta\nu = 235$ $cm^{-1}$. This indicates that it is a monodentate coordination.

To prove the individuality of the crystal lattices of ketoprofen, potassium ketoprofen, and the complex compound, an X-ray phase analysis of the initial substances and the synthesized coordination compounds was conducted, and diffractograms were compared (Figure 2).

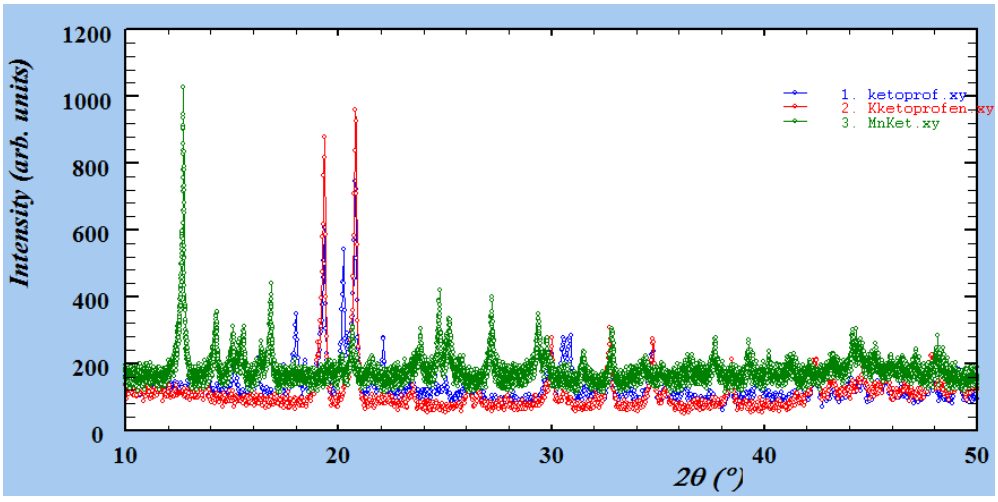



**Figure 2.** Comparative radiographs of ketoprofen (1), potassium ketoprofen (2), and complex compound (3).

It can be seen that ketoprofen has distinct diffraction peaks, confirming its crystalline structure. Compared to ketoprofen, the peaks of potassium ketoprofen have undergone

changes, but it also remains crystalline. The peaks are slightly displaced and some intensities are reduced, which may be related to the change in lattice parameters as a result of ion exchange. When a complex is formed, new diffraction peaks appear, indicating the formation of a new crystalline phase. The main peaks differ from the previous ones, indicating a structural change resulting from complex formation [14-15].

The thermogram in Figure 3 reflects the results of the thermal analysis of the complex compound obtained on the basis of manganese (II) chloride and potassium ketoprofen. The graph shows the results of TG (thermogravimetric), TG (differential thermogravimetry), and DTA (differential thermal analysis) [16-18].

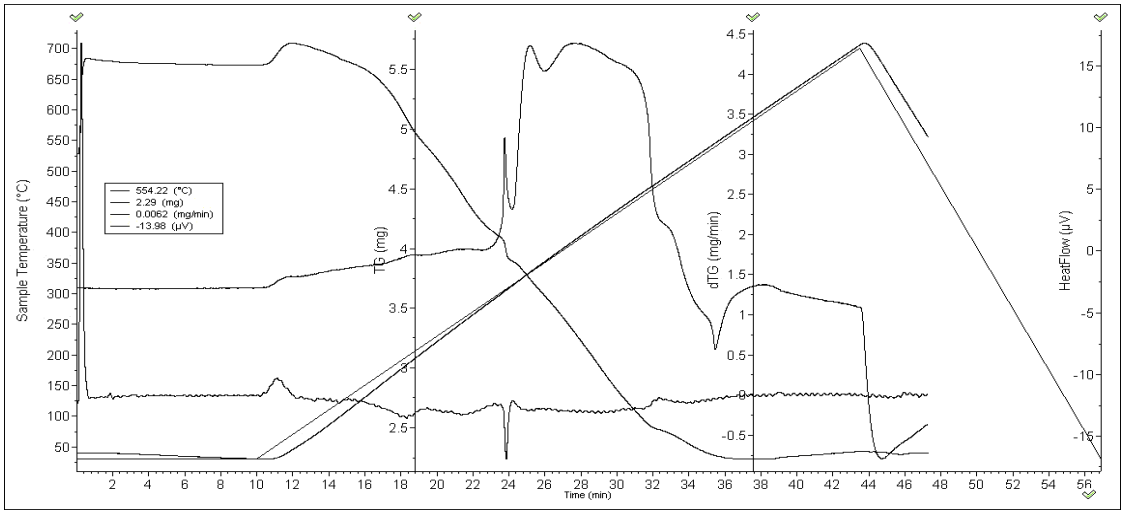



**Figure 3.** Derivatogram of a complex compound.

In the range of 100-150 °C, a small amount of mass loss is observed, which indicates the evaporation of water or crystal hydrates. In the range of 250-400 °C, the main decomposition process occurs, which indicates the decomposition of the organic part of the complex. Above 450 °C, final decomposition occurs, and the mass remains almost unchanged, indicating the formation of a solid residue (e.g., oxide or salt). According to the results of DTG (Differential Thermogravimetry), there are several distinct peaks on the DTG curve, which indicate the main stages of mass loss. The largest DTG peaks are observed in the range of 300-350 °C, indicating that this is the main thermal decay process. According to the DTA (Differential Thermal Analysis) analysis, exothermic and endothermic processes are observed on the DTA curve. There is an endothermic peak around 150 °C, which may indicate the release of water or other volatile substances. In the range of 250-400 °C, there are several exothermic peaks, which may be associated with the oxidation and decomposition of organic parts. The final exothermic peak is observed at a temperature above 450 °C, indicating the final decomposition of the residual substance.

## Conclusions

The obtained results confirm the formation of a new complex compound based on Mn (II) chloride and the potassium salt of ketoprofen. The complex was synthesized in

a 1:4 ratio and its composition was studied using elemental analysis, IR, and X-ray phase analysis methods. According to the IR spectrum analysis results, the ketone group of potassium ketoprofen participated in complex formation with the Mn (II) atom. This is confirmed by the results of the X-ray phase analysis, i.e., a new crystalline phase of the complex is observed. The thermal stability limit of the complex reaches approximately 250 °C. After 300 °C, the main part of the complex decomposes and loses its stability. After 450 °C, a solid residue forms and significant changes in the substance cease. In the resulting complex, the Mn (II) atom has a coordination number of 6 and forms a stable structure through carboxylate ligands. These results can serve as an important basis for studying the possibilities of using the complex in pharmaceutical and catalytic fields in the future.

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# STUDY OF THE DEPENDENCE OF THE FORCED CARBONIZATION RATE OF A LIME SYSTEM ON CARBON DIOXIDE PRESSURE

**Mirzakulov Kholtura Chorievich**
*Professor (PhD), Department of Inorganic Modality Chemistry Technology, Toshkent Chemical Institute of Technology*

**Matchanov Sherzod Kamilovich**
*Associate Professor, Department of Chemical Technologies, Urgench State University named after Abu Rayhan Biruni*
sherzadkamilovich@gmail.com

**Saynazov Jasur Khalmirza Ugli**
*Doctorate Student, Department of Inorganic Modality Chemistry Technology, Tashkent Chemical Technological Institute*

**Nazarov Diyorbek Komil Ugli**
*Student, Department of Technologies and equipment of light industry, Urgench State University named after Abu Rayhan Biruni*

**Annotatsiya.** Ushbu maqolada oxakli xom ashyolarni majburiy karbonlashtirish jarayonining karbonat angidrid bosimiga bog‘liqligi o‘rganilgan. Laboratoriya maxsus qurilmasida majburiy karbonlashtirish jarayoni orqali qurilish materiallari ishlab chiqarishda 15 % namligi bo‘lgan namunalarni 0,6 MPa bosimda $Ca(OH)_2$ ning $CaCO_3$ ga aylanishi ya’ni karbonizatsiya darajasi 75-80% ni tashkil qilishiga doir ma’lumotlar bayon qilingan. Bu jarayonda oxakli chiqindilarni qayta ishlash,

$SO_2$ ni kamaytirish va iqtisodiy jihatdan foydali qimmatli materiallar ishlab chiqarish uchun tavsiyalar berilgan.

***Kalit so'zlar:*** *Karbonat angidrid, kalsiy karbonat, oxak chang, bosim, harorat, qurilish materiallari.*

**Аннотация.** В статье исследование зависимости процесса принудительной карбонизации известкового сыра от давления углекислого газа. С использованием лабораторной специальной установки приведены данные в процессе принудительной карбонизации для строительных материалов с образцами влажности 15% при давлении 0,6 МПа, где в результате превращения $Ca(OH)_2$ в $CaCO_3$ достигалась степень карбонизации 75-80%. В штате также даны рекомендации по переработке отходов, сокращению выбросов $CO_2$ и получению экологически чистых, экономически выгодных материалов.

***Ключевые слова:*** *Углекислый газ, карбонатные образования, известковая пыль, давление, температура, строительные материалы.*

**Abstract.** This article investigates the dependence of the forced carbonation process of lime-based raw materials on the carbon dioxide pressure. Using a laboratory special apparatus, data are presented on the forced carbonation process for producing construction materials from samples with 15% moisture content at a pressure of 0,6 MPa, where the transformation of $Ca(OH)_2$ to $CaCO_3$ resulted in a carbonation degree of 75-80%. The article also provides recommendations for the recycling of waste, reduction of $CO_2$ emissions, and the production of valuable materials that are economically beneficial.

***Keywords:*** *Carbon dioxide, calcium carbonate, lime dust, pressure, temperature, construction materials.*

## Introduction

The development of the industry has brought not only great convenience to human life but also caused many environmental problems. From the ground *disposal of fossil fuels* a sharp increase in greenhouse gas emissions in processes such as reprocessing and incineration can lead to a significant increase in climate change temperature rise. Scientific sources say that more than 35 billion tons of greenhouse gases are emitted into the atmosphere worldwide every year, and this is increasing every day. Among all greenhouse gases, $CO_2$ is the largest in size, is about 74 % [1-3].

Another environmental problem caused by the commissioning of manufacturing plants in the chemical industry is the gradual increase in solid waste generated in the production process. According to statistics in scientific sources, the accumulation of solid waste exceeded 60 billion tons, which led to huge waste disposal costs and high landfill area occupancy [4].

In recent times, the issue of saving natural resources and reducing the level of atmospheric pollution from various man-made emissions has become more urgent. An analysis of the state of the problem shows that much of industrial production is

characterized by low utilization of waste, which leads to an increase in the area of solid waste landfills. There are several large industrial enterprises on the territory of the Republic that contribute to the formation of anthropogenic changes in the region by releasing thousands of tons of waste and harmful substances into the atmosphere every year.

The manufacture of soda calcinated is no exception. The chemical process for the production of calcinated soda using ammonia technology is based on five reactions, one of which is the production of calcium oxide and carbon dioxide by burning calcium carbonate in lime furnaces [5-7]. For further use, the carbon dioxide purification results from obtaining a by-product such as lime dust, which is distinguished by low activity and high content of calcium carbonate mixture. The reason for its partial sale can be viewed as less active lime. However, this does not allow us to avoid the possibility of this by-product accumulating in landfills and the negative impact on the environment. The solid and liquid waste from the enterprise contains calcium compounds, which are discharged into the vicinity of the plant in large quantities. We can see from scientific literature and articles that scientists of our republic have conducted a number of scientific research works on the disposal of this type of waste. We analysed the amount of calcium oxides in the waste of the soda factory and conducted scientific research on the possibilities of producing new types of building materials by means of its forced carbonization.

Forced carbonization is an active solidification process that allows obtaining materials with high physical and mechanical properties in a short time (1-3 hours) [8-10]. However, issues related to increasing the efficiency of the production technology of artificially carbonated building materials and products are of scientific and practical interest.

Therefore, the treatment of solid waste with carbonate and its subsequent application in cement-based materials requires not only large amounts of $CO_2$ and prevents the accumulation of excess waste while mastering [11]. Ongoing research on solid waste carbonization focuses mainly on steel slurries, furnace slurries, fly ashes and their carbonation recycling [12]. But to make these processes happen, the CO needs to$_2$ Very little research has been done on the kinetics of quantity, intensity, and pressure. This research work attempts to elucidate these problems. The mechanism of the carbon reaction in calcium-containing materials is reviewed, the results of the research on the methods used to improve the level of carbonation are presented to absorb $CO_2$. The purpose of this article is to apply the kinetics of forced carbonization of calcium waste to the application of effective technologies and $CO_2$ to contribute to the reduction of the population.

Based on our previous work [13], it was possible to determine the laws of exposure of carbon dioxide quantities to the forced carbonization process of ecosystems, as well as the dependence of the carbonization rate of semi-dry-pressed samples on the amount of $CO_2$ and other technological factors. Since it is most convenient to pressure regulation and control of the carbon dioxide content in the reactor where forced carbonization occurs, the study of the carbonization process of the lime system was

carried out by conducting laboratory experimental studies of the carbonization hardening of lime-based system samples under specially created conditions at different $CO_2$ pressures.

In the work, a mortar cast of 0,5–1 mm was used, which is used in the process of burning the oak stone. Lime dust has the following indicators; 69 per cent; Drain time – 110 s; The extinguishing temperature is 98 ℃.

The raw material obtained for the experiment was first quenched under normal conditions to determine the physicochemical properties of lime dust. In order to remove unquenchable, grain-shaped mixtures, the product holes were passed through a sieve of 1,25 mm and dried to a constant mass at a temperature of 110 ℃. This disambiguation page lists articles associated with the title Disambiguation.

**Table 1.** Chemical composition of quenched lime dust.

| $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | CaO | $K_2O$ | $Na_2O$ | $SO_3$ | $CO_2$ | $H_2O$ | KKM | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,10 | 1,37 | 0,38 | 0,05 | 71,69 | 0,16 | 0,08 | 0,15 | 3,73 | 20,33 | 24,05 | 100 |

The rate of conversion of $Ca(OH)_2$ to $CaCO_3$ or the carbonization rate of lime was determined in accordance with the chemical equation of the reaction during its transition to $CaCO_3$ by the ratio of the mass of calcium hydroxide to the theoretical increase of $Ca(OH)_2$:

$$Ca(OH)_2 + CO_2 + H_2O \rightarrow CaCO_3 + 2H_2O \qquad (1)$$

$$\alpha = \frac{\Delta m_{обр.}}{1{,}351 \cdot m_{Ca(OH)_2}} \times 100\,\%, \qquad (2)$$

where the increase in the mass of the lime sample at any point in the time of Δm-carbonization is g; the coefficient that takes into account the change in the mass of the system at 100% rotation of 1,351-$Ca(OH)_2$ to $CaCO_3$; m $Ca(OH)_2$ is the mass of $Ca(OH)_2$ in the sample, g.

Research was carried out on lime powder added samples-semi-dry pressing cylinders with a diameter of 40 mm. In the preparation of test samples, lime sample was 20 g, press pressure 10 MPa. Disambiguation pages with short descriptions the initial water content of the lime dust supplemented samples in the experiment was 5 to 15%. Carbonization of samples was carried out at 100% of carbon dioxide concentration medium at varying temperatures of 25 ℃, 50 °C, and 100 °C and at various $CO_2$ pressures. Carbon dioxide pressure values varied over a wide range: from vacuum pressure (about 0,1 MPa) to overpressure (up to 0,6 MPa).

Kabel (disambiguation), according to the chemical equation (1) of calcium hydroxide carbonization, 1 mol of $CO_2$ is needed to convert 1 mol of $Ca(OH)_2$ to calcium carbonate. Therefore, the carbonization rate of the lime can be controlled by the amount of carbon dioxide supplied to the carbonization reactor. However, according to the literature data [14, 15], absolute carbonization of $Ca(OH)_2$ is almost impossible, since a low-permeability barrier layer is formed on the surface of calcium hydroxide particles consisting of saturated aqueous solutions (various hydrocarbonates

and calcium carbonates) of solid carbonization products-calcium carbonate and carbonization intermediate products.

Nevertheless, by controlling the reactor volume and the amount of calcium hydroxide involved in the carbonization reaction, it is theoretically possible to calculate the pressure providing the amount of $CO_2$ in the reactor for the complete conversion of $Ca(OH)_2$ into $CaCO_3$. Corresponding calculations were carried out, taking into account the conditions of laboratory tests for forced carbonization hardening of lime samples - semi-dry pressing cylinders. The results are presented in Table 2. The size of the laboratory carbonization chamber was 248,64 $cm^3$, the sample size was 20,205 $cm^3$, the porosity of the sample was 50%, the $Ca(OH)_2$ content in the sample was 0,2226 moles.

**Table 2.** Calculation of the $CO_2$ content and quantity of lime samples at different pressures and forced carbonization temperatures relative to $Ca(OH)_2$ in a laboratory carbonization chamber.

| In Sarara, Achi/Sec | $CO_2$ pressure, MPa | $CO_2$ gas density, kg/m3 | $CO_2$ mass camera, m | The amount of $CO_2$ in the chamber, the quantity | $CO_2$ / $Ca(OH)_2$ ratio, mol/mol |
|---|---|---|---|---|---|
| 25 | 0,1 | 1,841 | 0,4383 | 0,0100 | 0,0449 |
| | 0,3 | 2,789 | 0,8765 | 0,0188 | 0,0844 |
| | 0,4 | 6,444 | 1,5339 | 0,0322 | 0,1446 |
| | 0,5 | 9,206 | 2,1911 | 0,0489 | 0,2196 |
| | 0,6 | 10,102 | 3,1012 | 0,0512 | 0,2300 |
| 50 | 0,1 | 1,722 | 0,4189 | 0,0095 | 0,0426 |
| | 0,3 | 4,103 | 0,7996 | 0,0189 | 0,0849 |
| | 0,4 | 6,025 | 1,4139 | 0,0312 | 0,1401 |
| | 0,5 | 8,608 | 2,0690 | 0,0441 | 0,1981 |
| | 0,6 | 9,912 | 3,3122 | 0,0532 | 0,2389 |
| 70 | 0,1 | 1,616 | 0,3748 | 0,0089 | 0,0399 |
| | 0,3 | 3,233 | 0,7780 | 0,0165 | 0,0741 |
| | 0,4 | 5,657 | 1,3544 | 0,0306 | 0,1374 |
| | 0,5 | 6,989 | 1,8989 | 0,0412 | 0,1850 |
| | 0,6 | 8,082 | 2,8936 | 0,0532 | 0,2389 |
| | **6** | **86,329** | **23,4543** | **0,4684** | **2,1034** |

Table 2 shows that when the pressure rises to 0,6 MPa, the amount of $CO_2$ in the chamber increases, which is not enough to completely convert $Ca(OH)_2$ to $CaCO_3$. With an increase in temperature, the carbon dioxide content in the carbonization chamber decreases. Disambiguation pages with short descriptions, a gas with such properties can be available at a pressure of 6 MPa and a temperature of 100 ℃ [16], or the chamber must be 5 times larger than the volume of the material loaded into it. To create such conditions is technologically and technically difficult, and, moreover, not cost-effective. The most reasonable way to organize carbonization hardening of lime materials is a method in which a continuous stream of carbon dioxide is fed into the hardening chamber. The hardening rate can be controlled by maintaining a high concentration of $CO_2$, its quantity and by pressure regulation.

Experimental data on changes in the degree of conversion of $Ca(OH)_2$ to $CaCO_3$ as a result of forced carbonization of semi-dry-pressed samples with $CO_2$ temperature, concentration, pressure, and humidity of 10 % obtained in our experimental studies are presented in Figure 1.

Analysis of the carbonization kinetics curves of lime system samples with semi-dry pressing cylinders shows that the indicator of the carbonization level of lime increases with an increase in pressure and an increase in the initial water content of lime. In addition, various variations of the studied factors demonstrate the peculiarities of lime carbonization. At a temperature of 50 °C and at pressures of 0,1 – 0,3 MPa at pressures of 0,1 – 0,3 MPa, the kinetic curves characterizing the development of carbonization of samples at time intervals of 900 – 5400 s do not differ sharply from each other. As the time interval increases, it was observed that $CO_2$ at pressures of 0,3 MPa reaches a carbonation index of α-20 % above 5400 s.

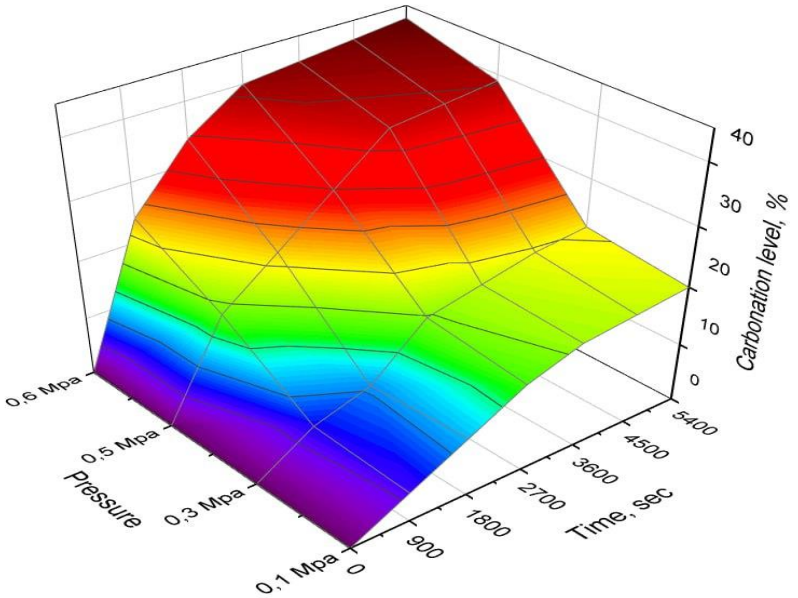


**Figure 1.** The correlation of the level of carbonation of samples with the moisture content of 10 % is on the pressure of $CO_2$.

It was found that the carbonization rate of lime system samples increases at pressures above atmospheric pressure, especially at the initial stage of carbonization, which covers a period of 3600 s, the carbonization line of lime system samples at a pressure of $CO_2$ 0,5-0,6 MPa. This curve is characterized by the presence of two periods: the first period, which includes 0 – 2700 s, and the second period, in which the rate of conversion of lime to calcium carbonate at a constant rate up to 35,5 % does not change, and the degree of conversion of alkali to calcium carbonate does not change. At high atmospheric pressures, after 3600 s, the carbonization rate of $Ca(OH)_2$ was found to be 35-40 % in the pressure range of 0,5 – 0,6 MPa. With the increase in the carbonization temperature to 100 °C (see Figure 2), it was observed that the difference in the carbonization level indices of carbonized samples at different pressures was slightly higher than at 50 °C, but the kinetic curves and the overall appearance of the carbonization level indicators varied around 35-40 %.

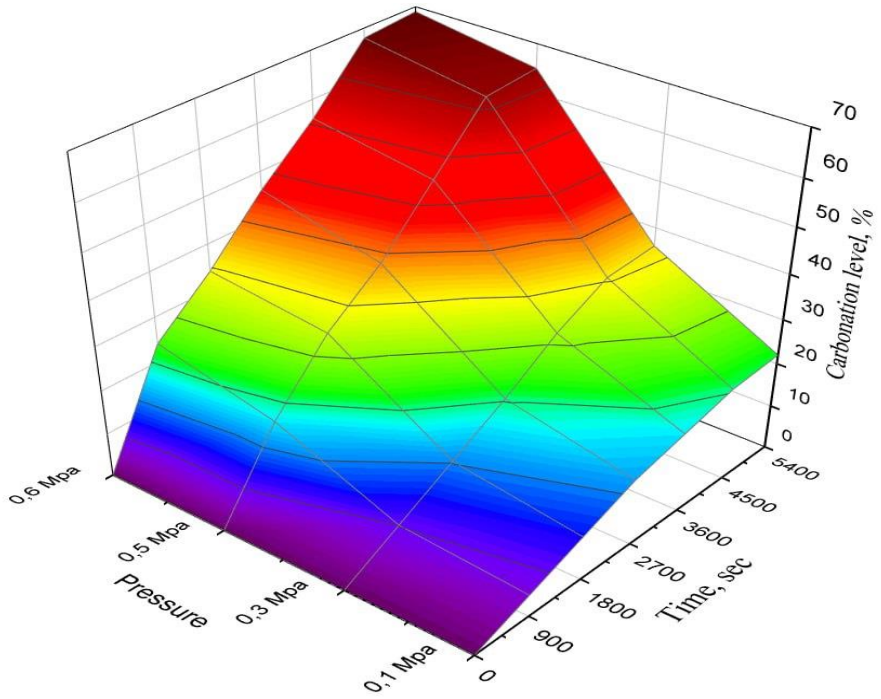


**Figure 2.** The carbonation level of samples with the moisture content of 15% is dependent on the $CO_2$ pressure.

At a pressure of 0,5-0,6 MPa compared to 0,1-0,3 MPa at temperature, it was found that the change in velocity and the degree of rotation was slightly significant: with the increase in pressure to 0.1 MPa, under normal conditions, the indicators increased by 25 % compared to samples with 10% humidity, and the pressure was α – 35,8 % of the carbonization rate above atmospheric pressure (0,3 MPa and 3600 s). In the carbonization chamber, increasing the $CO_2$ pressure to 0,5-0,6 MPa in the range of 900 - 5400 s was observed to increase the level of forced carbonization by 65-68 %.

## Conclusions

The carbonization rate of lime system samples was pressed at 15 % moisture and the carbonization rate of lime system samples was α - 60.7 %, depending on the studied factors given in Figures 1-2. At the same time, both the indicators of the carbonization rate and the nature of its change will depend on all the factors studied. The forced carbonization rate of lime systems is highly dependent on $CO_2$ pressure, while $CO_2$ pressure has the greatest influence on limestone carbonization rate, which is explained by an increase in carbon dioxide content in the carbonization chamber and respective adsorption to $Ca(OH)_2$ particles. Increasing pressure increases the process speed, which can be applied to the quality of building materials. However, it is recommended as optimal pressure values to ensure energy efficiency.

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# ANTIBACTERIAL ACTIVITY OF ALCOHOL EXTRACTS OF ALHAGI PSEUDALHAGI

**Abdullayeva Khosiyat Maqsudovna**
*Master Degree, Urgench State University named after Abu Rayhan Biruni*
abdullayevax965@gmail.com

**Annotatsiya.** Alhagi - Fabaceae oilasiga mansub Qadimgi dunyo o‘simliklarining bir turi. Ular odatda tuyalar yoki manna daraxtlari deb ataladi. Shimoliy Afrika va Gretsiyadan G‘arbiy va Markaziy Osiyo orqali Hindiston va Shimoliy Xitoygacha bo‘lgan to‘rtta qabul qilingan tur mavjud. Tuya tikanining yer usti qismidan olingan ekstraktlar mikroblarga qarshi ta’sirga ega va ular streptokokklar, stafilokokklar va dizenteriya tayoqchalariga aniq bakteritsid ta’sir ko‘rsatadi. Qaynatmalar o‘tkir tonzillit uchun tomoqni yuvish vositasi sifatida muvaffaqiyatli qo‘llaniladi.

***Kalit so‘zlar:*** *Alhagi, Staphylococcus aureus, Escherichia coli, Bacillus subtilis.*

**Аннотация.** Alhagi — род растений Старого Света из семейства Бобовых. Их обычно называют верблюжьими колючками или манновыми деревьями. Существует четыре признанных вида, которые произрастают от Северной Африки и Греции через Западную и Центральную Азию до Индии и Северного Китая. Экстракты из надземной части верблюжьей колючки обладают антимикробным действием, а также имеют выраженное бактерицидное действие на стрептококки, стафилококки и дизентерийные палочки. Отвары успешно применяются в качестве полоскания при остром тонзиллите.

***Ключевые слова:*** *Alhagi, золотистый стафилококк, кишечная палочка, сенная палочка.*

**Abstract.** Alhagi is a genus of Old-World plants in the family Fabaceae. They are commonly called camelthorns or manna trees. There are four accepted species, which range from northern Africa and Greece through western and central Asia to India and northern China. Extracts from the above-ground part of camel thorn have an antimicrobial effect, and they have a pronounced bactericidal effect on streptococci, staphylococci, and dysentery bacilli. Decoctions are successfully used as a gargle for acute tonsillitis.

***Keywords:*** *Alhagi, Staphylococcus aureus, Escherichia coli, Bacillus subtilis.*

## Introduction

Camel thorn (Figure 1), jantak, yantak (lat. Alhagi) is a genus of plants of the legume family, growing in deserts. The camel thorn grows in the desert thanks to its root system, which goes 3-4 meters deep. Camel thorn is one of the main pasture plants in

the desert zone. Persian camel thorn (Alhagi persarum) is rich in sugars, which are released from its stems in warm weather, solidifying into lumps (manna). Prickly subshrubs with a deeply penetrating root system. Plants are 30-100 cm tall. The root is long, with deeply located horizontal branches. The stems are branched, woody in the lower part. The spines in the leaf axils are directed upward at an acute angle, 2-3 cm long. The leaves are simple, alternate, oblong, blunt, 1-2 cm long. Flowers are 3-8 on a spine, of a typical butterfly structure, red or pink. It blooms from May until late autumn, the fruits begin to ripen in July. The beans are naked, bead-shaped, with 4-5 kidney-shaped seeds.

The plant contains flavonoids, saponins, sugars, tannins, vitamins C, K and B, carotene, ursolic acid, traces of alkaloids, essential oil, dyes, resins. In medicine, the above-ground part (grass) of camel thorn is used, less often the fruits and roots. The grass is dried under a canopy, pre-chopped [1].

**Figure 1.** Alhagi plant.

In folk medicine, an infusion or decoction of the plant's herb is used as a diuretic and diaphoretic. Sometimes they are drunk to soften a cough during colds. More often, infusions, decoctions or fresh juice are drunk for gastrointestinal diseases, mainly chronic diarrhea and dysentery. Extracts from the above-ground part of camel thorn have an antimicrobial effect, and they have a pronounced bactericidal effect on streptococci, staphylococci, and dysentery bacilli. Decoctions are successfully used as a gargle for acute tonsillitis [2]. Sometimes a decoction of camel thorn is used in folk medicine to treat hemorrhoids (baths, rinsing), for external treatment of eczema, pustules, festering wounds and ulcers (washing, compresses).

Types:

* Alhagi canescens * Alhagi graecorum
* Alhagi kirghisorum * Alhagi maurorum

It grows in dry steppes, clay and stony semi-deserts and deserts, along the banks of rivers and canals, on wastelands and fallow lands. Alhagi pseudalhagi is a semi-shrub with a very long root and deeply located underground horizontal shoots, with a splayed-branched stem, numerous thorns [3]. The leaves are simple, oval. The flowers are of a

butterfly structure, pink or red, located on thorns. The pod is naked, bead-like, 4-5 (7)-seeded. The roots of common camel thorn contain: alkaloids (traces), glucose, tannins (traces), resinous substances (5%), organic acids, vitamin C (70 mg%), sugar, fatty substances (0.65%). Flowering time: May - August [4-6].

Alhagi pseudalhagi grows in semi-deserts, deserts, dry foothills and river valleys on clay, saline and sandy soils. The parts used are leaves and roots. Collection time: leaves are collected in May - August, roots - in late autumn. The thorn is used to prevent dysentery, inflammation of the colon and duodenum and gall bladder, gastritis and gastric ulcer, sometimes prescribed for colds, sore throats and coughs. Externally, it is used to treat purulent wounds, pustular skin diseases and eczema, and is instilled into the ears for purulent otitis. Baths of camel thorn grass are used to treat hemorrhoids and rickets in children. A decoction and tincture of the herb are also used to treat cervical erosion [7-10].

## Research Methodology

The plants were collected by us in the Khorezm district of the Astrakhan region. Parts of the plants were washed, dried and extracted separately with 40 % alcohol for 48 hours with periodic shaking. The extracts were filtered, sterilized and stored in the refrigerator.

Conditions for culturing strains. *Staphylococcus aureus* and *Escherichia coli*: Medium L: yeast extract - 5.0, peptone - 15.0, NaCl - 5.0, agar - 15.0, distilled water - 1.0 l; temperature 37 °C. *Bacillus subtilis*: MPA (Meat-peptone agar), temperature 55 °C.

The antibacterial activity of plant extracts was determined in two ways: diffusion cup on a nutrient agar medium. Extracts were made in nutrient agar plates using a stopper borer (6 mm) and the inoculum containing 106 colony forming units (CFU)/ml bacteria was spread on solid plates with a sterile swab soaked in the bacterial suspension. Then 50 µl of the extract was placed in plates, a control also included 50 µl of 40% alcohol. Disc diffusion method. The disks were introduced into a clean glass bottle and sterilized at 121 °C for 15 minutes in an autoclave. The diluted decoction was used to test the extracts for antibacterial activity. Sterile disks (6 mm in diameter) were kept in camel thorn extracts (for 24 hours). All plates were incubated for 72 hours at 37 °C.

## Analysis and Results

The results of the analysis of antibacterial activity showed that both the essential oil and the alcoholic extracts of *Alhagi pseudalhagi* when used by the disk method confirmed some antibacterial activity of the essential oil and extracts against the activity of all the studied bacteria: Staphylococcus aureus, Bacillus subtilis, and Escherichia coli. Antibacterial activity in terms of growth inhibition zone is shown in Table 1.

**Table 1.** Antibacterial activity of essential oil and alcohol extracts of the studied plants against some bacteria in 50 µl (inhibition zone is measured in mm).

| Option | Diameter of growth inhibition zone (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Escherichia coli*** | | | ***Staphylococcus aureus*** | | | ***Bacillus subtilis*** | | |
| | *24 h* | *48 h* | *72 h* | *24 h* | *48 h* | *72 h* | *24 h* | *48 h* | *72 h* |
| *Alhagi pseudalhagi* extract | 13,5 ± 0,35 | 12,0 ± 0,50 | 12,0 ± 0,50 | 13,0 ± 0,50 | 12,0 ± 0,35 | 12,0 ± 0,35 | 14,5 ± 0,55 | 13,6 ± 0,80 | 13,5 ± 1,11 |

Discs with an alcoholic extract of Alhagi pseudalhagi showed low inhibitory activity against Staphylococcus aureus, Bacillus subtilis, and Escherichia coli with a narrow inhibition zone of 12.0-14.5 mm.

Table 2 shows the effect of essential oil and alcohol extracts on the growth of S. aureus, B. subtilis, and E. coli using the well method.

**Table 2.** Antibacterial activity of essential oil and alcohol extracts (well method) of the studied plants against some bacteria in 50 µl (inhibition zone is measured in mm).

| Option | Diameter of growth inhibition zone (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Escherichia coli*** | | | ***Staphylococcus aureus*** | | | ***Bacillus subtilis*** | | |
| | *24 h* | *48 h* | *72 h* | *24 h* | *48 h* | *72 h* | *24 h* | *48 h* | *72 h* |
| *Alhagi pseudalhagi* extract | 13,5 ± 0,25 | 13,0 ± 0,25 | 13,0 ± 0,35 | 12,3 ± 0,25 | 10,0 ± 0,35 | 10,0 ± 0,35 | 13,7 ± 0,80 | 12,6 ± 0,62 | 12,2 ± 0,50 |

According to our data, the essential oil obtained from *Alhagi pseudalhagi* has a weak growth inhibition effect on the above-mentioned bacteria. Plant extracts have been used for hundreds of years in folk medicine to target disease-causing microorganisms. A systematic study of the effect of plant extracts on antibacterial activity is carried out to obtain new antibacterial compounds.

Considering the rich biodiversity of plants in the Khorezm region, it is necessary to carry out further comprehensive studies of the identified biocomponents of these plants to detect their antibacterial activity.

The need to combat microbial resistance to antibiotics is increasing globally. Staphylococcus aureus is one of the gram-positive microorganisms that has been shown in numerous studies to be resistant to a wide range of commonly available antibiotics. Thus, new chemotherapeutic agents and new approaches are urgently needed to combat such antibiotic-resistant bacteria. Synergism between known antibiotics and bioactive plant extracts is a new concept and may be beneficial (synergistic or additive interactions) or detrimental (antagonistic or toxic) despite the rich literature on the antimicrobial properties of plant extracts.

Each individual, pure essential oil is composed of several, sometimes hundreds of different natural chemicals. Many of these have antimicrobial activity, and may show synergistic effects; mixtures of chemicals - as oils occur in nature - may be more powerful than any single chemical component.

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# GRAIN QUALITY INDICATORS OF WINTER SOFT WHEAT

**Khamraev Nurbek Ulugbekovich**
*Senior researcher (PhD), Department of Natural sciences, Khorezm Mamun academy*
nurbek.hamraev@gmail.com

**Yuldasheva Shakhnoza Xasanboyevna**
*Doctorate Student, Khorezm Mamun academy*
shaxnozayuldasheva@gmail.com

**Annotatsiya.** Ushbu maqolada Don va dukkakli ekinlar ilmiy tadqiqot instituti Xorazm tajriba-stansiyasida yetishtirilayotgan 21 ta kuzgi yumshoq bug‘doy navlarining don sifati ko‘rsatkichi laboratoriya tajribalarida o‘rganilgan. Xorazm viloyatining tuproq-iqlim sharoitida kuzgi yumshoq bug‘doyning Andijon-2, Jiva, Karavan, Kroshka, MV-Nemere va Step navlaridan sifatli don olishga erishilgan. Xorazm tajriba stansiyasida yangi navlarni yaratish maqsadida sifatli don beradigan navlar seleksiya ishlarida foydalanilgan.

***Kalit so‘zlar:*** *Kuzgi yumshoq bug‘doy, nav, 1000 don og‘irligi, don naturasi, oqsillar, kleykovina miqdori va deformatsiya indeksi (KDI), tuproq-iqlim sharoitlari.*

**Аннотация.** В данной статье в лабораторных экспериментах изучен показатель качества зерна 21 сорта озимой мягкой пшеницы, выращенной на Хорезмской опытной станции НИИ зерновых и зернобобовых культур. В почвенно-климатических условиях Хорезмской области удалось получит высококачественное зерно от сортов озимой мягкой пшеницы Андижан-2, Жива, Караван, Крошка, МВ-Немере и Степ. На Хорезмской опытной станции в селекционной работе по созданию новых сортов использовались высококачественные сорта зерна.

***Ключевые слова:*** *Озимая мягкая пшеница, сорт, масса 1000 зерен, натура зерна, белки, содержание клейковины и индекс деформации (ИДК), почвенно-климатические условия.*

**Abstract.** In this article, the grain quality of 21 winter soft wheat varieties at the Khorezm Experimental Station of the Scientific Research Institute of Cereals and Legumes was studied in laboratory experiments. In the soil-climatic conditions of the Khorezm region, it is possible to obtain high-quality grain from winter soft wheat varieties Andijon-2, Jiva, Karavan, Kroshka, MV-Nemere, and Step. Varieties with high grain quality are involved in the breeding program at the Khorezm Experimental Station.

***Keywords.*** *Winter soft wheat, variety,1000 grain weight, grain nature, proteins, gluten content and defamation index (GDI), soil-climatic conditions.*

## Introduction

In 2024, the Republic of Uzbekistan produced more than 9 million tons of grain from cereal crops. This indicator is increasing year by year, but the quality of the grown grain cannot always meet the demand for bread and pasta products. In order to grow high-quality grain, it is necessary to carry out agrotechnical activities in a timely and high-quality manner. At the same time, breeders should conduct scientific research on the creation of new high-yielding and high-quality cereal varieties. Only then it is possible to increase grain yield and grain quality.

## Literature Review

Wheat is a staple food for 36% of the global population [1-12], and one of the most popular cereal crops around the world [13-17]. Wheat has a considerable advantage over other strategic cereals in terms of global food security because it easily adapts to varied environmental conditions due to its high plasticity [4].

In 2019-2021, the world's leading wheat producers were China (135 million tons), India (107 million), Russia (79 million), the United States (49 million), France (35 million), Canada (30 million), and Ukraine (29 million) [15]. Wheat is also a main cereal in Uzbekistan too. In 2024, Uzbekistan produced more than 9 million tons of grain. Due to the observed increase in the global human population, wheat will continue to play an important role as a strategic cereal crop for sustaining food security.

At present, hexaploidy common wheat (*Triticum aestivum* L.) accounts for 95% of the wheat grown worldwide, whereas the remaining 5% is mostly tetraploid hard wheat

(*T. durum Dest.*) [18]. Common wheat grown for consumption should be characterized by high yields and high technological quality [8]. The processing suitability of wheat is determined by grain quality attributes, including the physical properties of grain that influence its milling quality and the protein complex, the starch complex, and the activity of amylolytic enzymes [11].

The wheat grain quality is considered in two aspects – its nutritional value, which depends on the protein content and its components, and its technological properties, which characterize the grain suitability for the production of flour and bread. Physical properties of the grain (weight of 1000 grains, unit, vitreosity) indirectly determine the milling and baking qualities [6].

The technological quality of grain is determined mostly by the wheat cultivar and its genetic profile [10], as well as weather conditions in the generative growth phase of wheat plants [7]. However, mistakes in the wheat production technology can decrease grain quality [13]. Nitrogen (N) fertilization is an agricultural management practice that exerts the greatest impact on the technological quality of wheat grain [19]. Grain quality is significantly affected not only by the N rate, but also by the method and date of N application [16].

In the soil and climate conditions of the Khorezm region, it is important to select varieties of winter soft wheat suitable for the conditions of irrigated lands, with stable productivity, high grain quality, resistant to adverse natural climatic conditions, and intensive type. The purpose of the conducted research is to test varieties of winter soft wheat that produce quality grains in irrigated lands and to determine their biochemical parameters.

## Research Methodology

Field research and laboratory experiments were conducted in 2023-2024. Twenty-one varieties of winter soft wheat were obtained from the Khorezm Scientific Research Institute of Cereals and Legumes. Varieties were grown using the same agrotechnics in the soil-climatic conditions of the Khorezm region. The Krasnodarskaya-99 variety was taken as a control variety. Grain quality indicators such as 1000 grain weight, grain nature, gluten content, and gluten defamation index (GDI) of the varieties were studied. “UzST13586.1-68-Determining the amount and quality of wheat gluten” method was used to determine the amount of gluten in the grain and the gluten defamation index (GDI) [5]. Laboratory experiments were carried out in the laboratory “Analysis of Cereal Crops and Products” of the Khorezm Mamun Academy.

## Analysis and Results

The weight of 1000 grains depends on the size and fullness of the grain and is one of the parameters for evaluating the quality of the dough. The flour-yielding properties of wheat depend on the size of the grain, because the larger it is, the more endosperm is in the grain, and as a result, more flour is produced from such grains [2].

According to the results of the experiment, the weight of 1000 grains of the varieties was in the range of 30-45 grams. The highest result was observed in the varieties “MV-

Nemere" (45 g), "Karavan," "Jiva" and "Babur" (43 g). The lowest result was observed in "Vostorg" variety (30 g). In the control variety "Krasnodarskaya-99" this indicator was 38 grams.

The natural weight of wheat is one of the most common and at the same time simplest indicators of wheat quality. When determined in samples free of impurities and standard in moisture content, this indicator is closely related to the completion and density of the grain, as well as its size and shape. Nature is one of the class-forming indicators. In soft wheat of classes 1-2 the nature should be more than 750 g/l, in class 3 - at least 730 g/l and in class 4 - 710 g/l [9].

According to the results of the experiment, the grain content of the varieties was 705-847 g/l. The highest result was observed in "Andijan-2" variety (847 g/l) and "Karavan" variety (845 g/l). The lowest result was observed in "Vostorg" varieties (705 g/l).

The protein content of grain also significantly affects flour quality [14]. Storage proteins (gliadin and glutenin) play an important role during dough formation and are chiefly responsible for the baking value of wheat flour [20].

Gluten contained in grain is determined on the basis of the state standard of the Republic of Uzbekistan "Method for determining the amount and quality of wheat gluten-UzST-13586, 1-68" [5]. According to this standard, gluten is divided into 5 classes. The "high class" gluten content is 32-36 %, "class 1" gluten content is 28-31.9 %, "2nd class" gluten content is 23-27.9 %, "3rd class" gluten content when the amount is 18-2872.9 %, "class 4" is included when the amount of gluten is less than 18 %. In our experiments, there were no indicators of "high class" and "class 4" gluten content. The gluten content of varieties Krasnodarskaya-99, Ravnaq, Asr and Ultra varieties was included in the 1st class, and the gluten content of all other varieties was included in the 2nd class. The gluten content of all tested varieties was around 25.4-29.7 % (given in Table 1).

70-80 % of storage proteins in wheat grain are gliadin and glutenin proteins. Their ratio is approximately 1:1. The amount of protein varies depending on factors such as the genetic characteristics of the variety, fertilization, irrigation, and temperature [1].

In the experiments, the Gluten Defamation Index (GDI) parameter was divided into 5 groups. When determining the GDI indicator group of varieties, the quality group of Krasnodarskaya-99, Zimnitsa, Brigada varieties was found to be III, i.e. "unsatisfactory strong," and the quality group of all other varieties was found to be II, i.e. "satisfactory strong."

**Table 1.** Grain quality indicators of winter soft wheat varieties.

| № | Names of varieties | 1000 grain weight, gram | Grain nature, g/l | Gluten content, % | GDI |
|---|---|---|---|---|---|
| 1 | Krasnodarskaya-99 (control) | 38 | 835 | 29,7 | 107 |
| 2 | Andijon-2 | 40 | 847 | 27,6 | 91 |
| 3 | Andijon-4 | 39 | 819 | 27,1 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | ASR | 41 | 827 | 28,1 | 103 |
| 5 | Aziz | 38 | 841 | 27,5 | 93 |
| 6 | Bobur | 43 | 805 | 26,6 | 92 |
| 7 | Brigada | 41 | 838 | 27,1 | 105 |
| 8 | Drujba | 39 | 798 | 27,5 | 91 |
| 9 | Durdona | 38 | 815 | 25,6 | 88 |
| 10 | Gomer | 40 | 795 | 26,6 | 94 |
| 11 | Grom | 36 | 823 | 26,0 | 96 |
| 12 | Jiva | 43 | 840 | 27,2 | 96 |
| 13 | Karavan | 43 | 845 | 27,4 | 97 |
| 14 | Kroshka | 42 | 831 | 27,0 | 98 |
| 15 | MV-Nemere | 45 | 827 | 29,2 | 93 |
| 16 | Ravnaq | 38 | 830 | 29,7 | 95 |
| 17 | Step | 42 | 805 | 27,3 | 96 |
| 18 | Ultra | 38 | 795 | 28,5 | 95 |
| 19 | Vassa | 41 | 814 | 26,5 | 96 |
| 20 | Vostorg | 30 | 705 | 26,2 | 90 |
| 21 | Zimnitsa | 40 | 822 | 25,4 | 105 |

## Conclusion and Recommendations

Based on the research results, the following conclusions can be drawn:

1) Despite the fact that under the soil and climate conditions of the Khorezm region, the varieties of soft winter wheat are grown using the same agrotechnics, it was observed that the biochemical composition of the grain is different;
2) Among the varieties, the highest result in terms of gluten content was found in Krasnodarskaya-99, Ravnaq and MV-NEMERE varieties;
3) According to the GDI parameter, all varieties except Krasnodarskaya-99, Zimnitsa, Brigada were included in quality group II (satisfactory strength).
4) In order to obtain high-quality grain in the soil and climate conditions of Khorezm region, it is recommended to cultivate autumn soft wheat varieties such as Andijon-2, Khiva, Karavan, Kroshka, MV-Nemere and Step.

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# ANALYSIS OF THE IMPACT OF NEGATIVE ENVIRONMENTAL FACTORS ON PUBLIC HEALTH IN THE REPUBLIC OF KARAKALPAKSTAN

**Dauilbaeva Kulshat Kenesbaevna**
*Medical Institute of Karakalpakstan*
dayilbaeva80@mail.ru

**Babajanova Venera Aytekovna**
*Medical Institute of Karakalpakstan*

**Erejepova Gulzar Djumabaevna**
*Medical Institute of Karakalpakstan*

**Annotatsiya.** Maqola Qoraqalpog‘iston aholisining umumiy kasallanish darajasiga salbiy ekologik omillar tahliliga bag‘ishlangan. Maqolada olingan natijalar Qoraqalpog‘iston Respublikasining ekologik noqulay sharoitlarida atrof-muhitning aholi salomatligi holatiga ta’sirining umumiy qonuniyatlari bilan izohlanadi.

***Kalit so‘zlar:*** *Orol dengizi, chang bo‘ronlari, ekologik omillar, atrof-muhit, pestitsidlar, kollektor-drenaj suvlari, atmosferaning ifloslanishi.*

**Аннотация**. Статья посвящена анализу негативных экологических факторов на уровень общей заболеваемости населения Каракалпакстана. В статье полученные результаты объясняются общими закономерностями влияния окружающей среды на состояние здоровья населения в экологических неблагоприятных условиях Республики Каракалпакстан.

***Ключевые слова:*** *Аральское моря, пыльные бури, экологические факторы, окружающая среда, пестициды, коллекторно-дренажные воды, загрязнение атмосферы.*

**Abstract.** The article is devoted to the analysis of negative environmental factors on the level of general morbidity of the population of Karakalpakstan. In the article, the results obtained are explained by the general patterns of environmental influence on the health of the population in the environmentally unfavorable conditions of the Republic of Karakalpakstan.

***Keywords:*** *Aral Sea, dust storms, environmental factors, environment, pesticides, collector and drainage waters, atmospheric pollution.*

## Introductions

The strategy of transforming the habitat in order to satisfy man's continuously increasing needs, changing individual elements of the natural environment without taking into account the systemic organization of the relationship between nature and society has led to changes in a number of certain parameters of the natural environment, collectively reducing its quality and jeopardizing the possibility of sustainable

development. Environmental protection in the interests of preserving human health, in particular reducing the negative effects of exposure to harmful factors, remains a fundamental task of biomedical research [1, 2].

## Literature Review

In the last quarter of the XX century, as a result of a sharp decrease in the flow of waters of the Amudarya and Syrdarya rivers into the Aral Sea, the beginning of the drying of the Aral Sea in the territory of the Aral Sea disturbed the ecological balance, the external environment was degraded, and an extreme situation arose [1, 3, 5, 6].

Today, a complex set of environmental problems has formed in the Southern Aral Sea region, negatively affecting the health of the population. The current situation requires a transition to a new strategy of active, correct choice of solutions that prevent the negative consequences of the environmental crisis in the region.

Environmental pollution is a complex and multidimensional problem. In the conditions of drying up of the Aral Sea, this problem is aggravated by the removal of toxic salts (sulfates and chlorides) from the dried bottom. The dust and salt transfer factor (70 million tons/year) has become dominant in the deterioration of atmospheric air quality. Modeling of salt transport from the post-coastal land of the Aral Sea showed a multiple excess of MPC during salt and dust storms [4]. Due to atmospheric pollution, according to experts, the health status of the population has deteriorated markedly in a number of indicators. Atmospheric air pollution by salt and dust removal from the bottom of the dried-up part of the Aral Sea, and dust storms, lead to an exacerbation of chronic diseases, especially of the respiratory organs. Also, special attention to the structure of morbidity is drawn to the growth of such environmental-related diseases of the digestive system and oncological pathology [1- 3, 15-17].

The incidence of bronchial asthma is based on genetic and environmental factors. There are studies in which attempts have been made to establish which factors and under what conditions play a leading role, but no definitive answer has yet been found. Bronchial asthma, however, is considered an environmentally related disease, since atmospheric air pollution can cause the manifestation of the disease. In addition, non-specific respiratory tract irritation can be caused by gaseous or aerosol pollutants in concentrations exceeding MPC, and people’s sensitivity to various allergens has tended to increase in recent years [17, 19, 20].

According to some scientists [14, 15], a comprehensive examination of the respiratory organs in children of the Aral Sea region made it possible to identify new diseases with the peculiarities of the course of chronic diseases of the upper and lower respiratory tract, as well as to diagnose interstitial lung damage for the first time, leading to deep functional and cytomorphological changes in lung tissue, which is a consequence of the unfavorable situation and pollution of the air basin dust and salt particles.

## Analysis and Results

In order to obtain more objective information about the current state of the impact of atmospheric air pollution in the Republic of Karakalpakstan on the morbidity rate of the population, mathematical modeling was carried out using correlation and regression analysis using the Excel Microsoft program. Predictive calculations of health changes are performed only with the approximate values of those environmental factors for which a reliable influence on a particular health indicator has been proven. Based on this equation, a number of regression equations were obtained reflecting the dependence of the morbidity rate of the population for individual nosologies on the integral indicator of atmospheric air pollution in the studied regions of the Republic of Karakalpakstan.

$$Y_1=165,2+46,71*X_{1-16}$$

The obtained regression equation indicates a direct dependence of the level of respiratory morbidity of the population on the degree of atmospheric air pollution in the Republic of Karakalpakstan. It should be noted that in ecologically different regions of Karakalpakstan, the relationship between the degree of atmospheric air pollution and the level of observed morbidity of the population with respiratory diseases has its own qualitative and quantitative features. In the northern regions of Karakalpakstan, priority pollutants such as mixtures of nitrogen dioxide, carbon monoxide, and dust prevail in the atmospheric air.

Data on the high degree of atmospheric air pollution in the northern regions allowed us to expect a significant negative impact of atmospheric air on human health. The northern regions are located closer to the focus of the ecological crisis - to the drained bottom of the Aral Sea, and also in Kungrad, the Kungrad soda plant is of the greatest importance as a source of air pollution.

The analysis revealed that the highest incidence of allergic rhinitis is detected among the population in areas with high aerogenic pollution (In Kungrad, Muynak and Takhtakupyr districts).

In the southern regions, there is an increase in the incidence of respiratory diseases among the population of the Amudarya and Turtkul districts. According to the Ress data, it was established that storage sites for various mineral fertilizers, pesticides and herbicides were previously located on the territory of these areas, where residual amounts of pollutants of this kind are observed in the atmospheric air, as well as in food products.

Domestic scientists noted that the environmental factor is one of the leading factors in the formation of morbidity in the population of the Southern Aral Sea region. Polluted atmospheric air, soil and water serve as a source of pollution of livestock and plant products, which are later used by the population as food [14].

Water pollution has been studied in the works of students of medical and environmental problems of this region. Pesticides exceeding the norm were found in water samples from open reservoirs - hexachlorocyclohexane (HCG), cymbush. It was noted that the pesticides dust DDG, HCG, bronatok, fosalon, and cymbush were found in soil samples in excess of the norm. Also, the number of atmospheric air samples of detected pesticides exceeding the norms is given – bronataks, magnesium chlorate, and

cymbal. It is noted that contamination with pesticides and nitrates of food products has been decreasing in recent years, and nitrites is increasing, which the authors attribute to the intensity of the use of various fertilizers in agriculture in quantities [4].

Another way and factor of soil pollution is the water of the Amu Darya River, heavily polluted in the middle and lower reaches by collector and drainage waters.

According to many scientists, the use of more highly mineralized waters affects the mineral balance in the human body, which leads to the occurrence of a number of somatic diseases; increased chloride content in drinking water leads to an increase in the level of cardiovascular diseases. It is known that some chronic diseases are associated with the presence of certain chemical elements in drinking water, especially heavy metals. The effect of calcium and magnesium cations (hardness) on gallstone and kidney stone disease in humans has been clarified. According to the results of some studies, a significantly high incidence of complications during pregnancy and childbirth and reproductive pathology has been shown in areas with high mineralization of drinking water in Karakalpakstan [5]. Also, one of the diseases with progressive growth in recent years is anemia, which has become a marginal pathology [7].

## Conclusions

From the conducted studies, it can be determined whether negative environmental factors, depending on their quantitative severity, may or may not exacerbate the negative impact of anthropogenic factors, this is explained by general patterns of environmental influence on the health of the population in the environmentally unfavorable conditions of the Southern Aral Sea region. Due to atmospheric pollution, the health status of the population has deteriorated markedly in a number of indicators. From a medical and environmental point of view, this is due to the fact that shifts in the functional state of the body are more sensitive to the effects of environmental factors. The general effect of adverse environmental factors is to reduce the body's resistance, which can lead to an increase in preclinical forms of diseases and the level of general morbidity.

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# BASED ON THE MAIN CONSTRUCTION PARAMETERS OF KPP-3 MOWER-GRINDER ROTOR

**Kurambaev Bakhtiyor Rajabovich**
*Senior Researcher (PhD), Head of the laboratory Mechanization of dry lands and desert pastures, Scientific Research Institute of Agriculture Mechanization (SRIAM),*
Bakhtier.67@mail.ru

**Mirzaev Otabek Takhir Ugli**
*Assistant Teacher, Department of Transport systems, Urgench State University named after Abu Rayhan Biruni*
lidermirzayev@gmail.com

**Ismoilov Mirjalol Ruziboy Ugli**
*Assistant Teacher, Department of Transport systems, Urgench State University named after Abu Rayhan Biruni*
ismoilovmirjalol947@gmail.com

**Annotatsiya.** Ushbu qo‘llanmaning maqsadi KPP-3 o‘roq mashinasidan o‘roq mashinasining ish parametrlarini hisoblash va o‘roq mashinasining ishlashi uchun zarur bo‘lgan parametrlarni olishdan iborat bo‘lib, KPP-3 o‘roq mashinasidan o‘roq mashinasining ish parametrlarini hisoblash mumkin bo‘ladi.

***Kalit so‘zlar:*** *degradatsiya, tanazzul, yaylov, ozuqa, mashina, yem-xashak, o‘rgich-to‘plagich, cho‘l, kosilka-maydalagich, pichoq, segment, rotor, tadqiqot.*

**Аннотация**. В статье представлены основные схемы параметров ротора косилки-измельчителя КПП-3, собирающей кормовые растения с эстетическими пастбищами, характеристики рабочего процесса, результаты по обоснованию параметров ротора КПП-3 для измерения производительности и качества работы.

***Ключевые слова:*** *деградация, пастбища, машина, корм, косилка-копнитель, пустыня, косилка-измельчитель, нож, сегмент, ротор, исследование.*

**Abstract.** The basic parameterization schemes of the KPP-3 mower-shredder rotor, which collects nutritious fodder plants from natural pastures, the characteristics of the work process, the results of the parameterization of the KPP-3 rotor to improve productivity and quality are presented.

***Keywords:*** *degradation, decline, pasture, feed, machine, forage, harvester-gatherer, desert, mower-shredder, blade, segment, rotor, research.*

## Introduction

Measures for the sustainable development of pasture livestock in our country are of great importance in ensuring food security. This, in turn, requires the strengthening of forage reserves by improving low-yielding pastures. The process of harvesting nutritious plants in the desert requires a lot of hard work, which must be done in the hot climate of the desert. Therefore, the use of existing machines and mechanisms that allow the mechanization of the harvesting of nutritious plants allows to increase the efficiency of the field.

Today, during the analysis of accumulated experiences on the mechanization of the process of harvesting nutritious plants in the desert, it is worth noting that it is advisable to grind the plants with the help of rotor mowers, collect the collected mass in a hopper, and dump it in a heap when the hopper is full.

Uzbekistan , which occupies more than 23.6 million hectares of the territory, is extremely arid, accounting for 52% of the total area, including 17.8 million hectares of desert and semi-desert karakul pastures, almost all of which have large areas of degraded land, the amount of atmospheric precipitation, which is the only source of water, does not exceed 80-340 mm in different years, and therefore these areas do not meet the requirements of agricultural management. As important as it is to combat the degradation of pastures, the most important task is to collect fodder and forage products from them as efficiently as possible. Nevertheless, the development of desert areas for the needs of agricultural production is of great importance [1-2].

## Literature Review

The natural vegetation of the steppe region has long served as a year-round source of food for livestock (karakul sheep, goats, camels, large horned animals, and horses).

Academics V.P. Goryachkin and A. Yu. Ishlinsky, professor M.B. Uglanov, V.A. Jeligovsky, V.I. Fomin, Yu.F. Novikov, CB Melnikov, U. Chancellor, R. Prints, R. Feller, D. McRandall and P. McNulty, E.M. Gutyar, A.Yu. Ishlinsky, I.F. Vasilenko, N. Yu. Reznik, E.S. Bosoy studied unsupported cutting processes in rotor mower-shredders without a counter cutting element.

KPP-3 mower-shredders with a rotor whose axis of rotation is parallel to the horizontal plane (pasture surface) are mainly used for harvesting desert plants. During the rotation of the rotor blade in this mower It is not observed that the rod moves along the blade. That is, the speed of the knife during cutting The cutting process for the part whose direction is perpendicular to the axis of the stem reflects the state of normal cutting [3].

As Professor E.A. Bosoy noted, plant stems are cut with blunt knife edges. This is due to the high speed of the blades, which ensures the performance of two operations: breaking and stretching and tearing in a very short time. The process of separation of the stems from the main part occurs as a result of tearing off the cutting edge, as is the case when using a cutting tool with blades (blades, segments). As a rule, the cut of the stems is torn and uneven, and longitudinal cracks appear on the cut stem [4].

The theory of sliding cutting of plant stems confirms that it is the most promising solution both in terms of improving the quality of cutting and reducing energy consumption. Therefore, the use of sliding cutting elements in rotary cutting devices allows you to cut the stem with less force than by pulling it out.

Thus, there are two conditions for sliding shear:

1. The angle between the direction of the blade velocity and the normal force transmitted to the blade edge must be greater than the angle of friction of the stem along the blade edge.

2. The material being cut must be flexible (elastic, plastic).

The use of mowers equipped with rotary working bodies is economically expedient, since they have the highest efficiency, that is, they spend 60-65% of the energy supplied from the tractor's power take-off on mowing, while in other mowers this figure is only 30-40% [5]. While mower-shredders equipped with rotary working bodies perform the technological process at a forward speed of the unit of 10-15 km/s, mowers equipped with segmented working bodies perform the technological process at a speed of the unit of 5-10 km/s. Mower-shredders equipped with rotary working bodies perform the technological process faster than mowers equipped with segmented working bodies. Accordingly, if the relative resistance per 1 meter of width is 15-19 horsepower, then in segmented mowers this figure is 8-12 horsepower [6].

## Research Methodology

The analysis of rotary mower choppers for harvesting forage crops in natural pastures is carried out based on the results of previously conducted scientific research. The scheme for substantiating the main parameters of the rotor of the KPP-3 mower-chopper for harvesting forage crops in natural pastures was created based on the rules of drafting. Theoretical studies were carried out based on the basic rules of classical mechanics and higher mathematics. The substantiation of the main parameters of this machine was studied using theoretical methods and derived mathematical expressions based on the results of previous scientific research in this area by domestic and foreign researchers.

## Analysis and Results

The rotary cutting device of a mower-shredder intended for harvesting steppe plants and coarse crops is characterized by the following parameters (Figure 1):

1. The diameter of the circle passing through the hinges where the rotor blades are installed ($d_n$);
2. The diameter of the circle passed through the tip of the blades ($D_b$);
3. Constructive width of the blade working part ($b_n$);
4. Number of blades in one cutting plane ($n$);
5. Constructive width of the cobbler ($B_z$);
6. The angle of installation of the blade in the longitudinal-horizontal plane ($\alpha$);
7. The distance from the tip of the blade to the hinge ($h_n$).

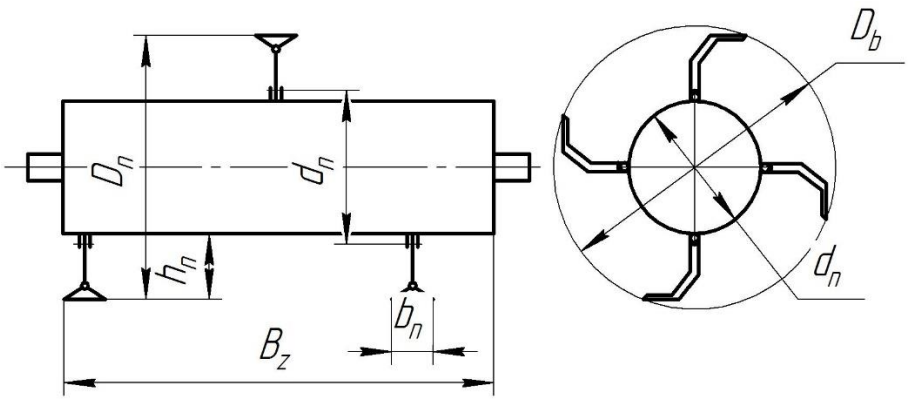


**Figure 1.** Scheme of justification of the main parameters of the rotor of the grinder: $B_z$ - constructive width of the rotor; $b_n$ – blade construction width of the blade working part; $D_b$ – the diameter of the circle passed along the tip of the rotor blades; $d_n$ - the diameter of the circle where p holes are installed on the rotor hinges ; $h_n$ - the distance from the tip of the blade to the hinge.

In the rotor, the blades are installed with the help of hinges and in width, when harvesting the fodder plants, when harvesting the vegetation on the surface of the pasture to the full extent, that is, when placing the blades, the width covers each other to a certain extent so that there are no uncut plants in the pasture.

The design width of the cutter rotor ( $B_z$ ) can be expressed by the design width of the working part of the blades ( $b_n$ ) as follows:

$$B_z = b_n z_{pl} / k_p \quad (1)$$

here $z_{pl}$ - the number of cutting planes ; $k_p$ -coefficient of overlap of cutting planes.

The total number of blades in the rotor can be expressed by the following formula:

$$z_n = n z_{pl} k_p \quad (2)$$

where n is the total number of blades placed in one cutting plane, in pieces, obtained an expression that allows us to determine the length of the chopped stems during the forage harvest process , and it has the following form: $l_{cp}$

$$l_{sr} = \frac{Hb}{0{,}5b + \frac{b}{2\pi}\arccos\frac{R_n - H}{R_n} + \sqrt{2R_nH - H^2}} \quad , (6)$$

where $H$ is the length of the cut stem (the length of the plant above the cut), m;

$b$ – transmission per one revolution of the rotor, m.

In addition, formulas are given here for the kinematic relationships that relate the known or assumed rotation speed of the drum and the required length of the plant parts:

$$D_b = \frac{l_{sr} n(v_0 - v_m)}{\pi v_m}, (6)$$

$$\omega_b = \frac{(v_0 - v_m)}{\pi D_b}, (7)$$

Here $\omega_b$ - drum rotation speed , rad /s .

the diameter of the circle passed along the tip of the blades, $D_b$ we put the following values in the above formula:

$l_{sr} = 0{,}1m$; n = 4 pieces; $v_0 = 10$ m/s; $v_m = 2$ m/s

After calculating these values by putting them into formula (6), we determine that the diameter of the circle drawn along the tip of the blades $D_b = 0{,}5m$.

between the blades in one cutting plane located on the drum $\alpha$ by this expression:

$$\alpha = 90^0$$

Designing rotary cutting devices and determining their geometric and kinematic parameters is one of the most important problems. Research in this direction was carried out by Yu. F. Novikov [8] and V. I. Fomin [9]. This is due to the fact that their rotor angular velocity $\omega$, the number of blades in it n, the constructive width of the working part of the blade, $b_n$ proposed the following formula expressing the relationship between the speed of the unit's advance movement : $v_m$

$$b_n = \frac{2\pi v_m}{\omega n}, \quad (8)$$

To find the value of the constructive width of the working part of the blade, the values of the parameters in the formula are: number of blades in the drum $n = 4$; angular velocity of the rotor $\omega = 100{,}531\,\text{rad}/s$; forward speed of the combine harvester $v_m = 4m/s$; (8) After calculations, the constructive width of its working part of the blade is $b_n = 0.0628$ m. If the width of the working part of the blade is 6.28 cm, then we determine its actual length using the scheme in Figure 2. When the condition of sliding cutting is met, the angle of inclination of the velocity vector should be greater than $\gamma$ the angle of friction between the cut branch and the blade ($\tau$). The value of the angle of friction between the steel and the plant stem is about 40° [10]. In this case if we take the inclination angle between the direction of the blade speed vector and the normal force transferred to the blade blade $\gamma = 50^0$, the condition of sliding cutting is fulfilled and the power spent on cutting reaches the minimum level to find the constructive width ($B_Z$) of the mower shredder rotor, we substitute the values corresponding to expression (1) and calculate, and we find that its value is 3.0 m.

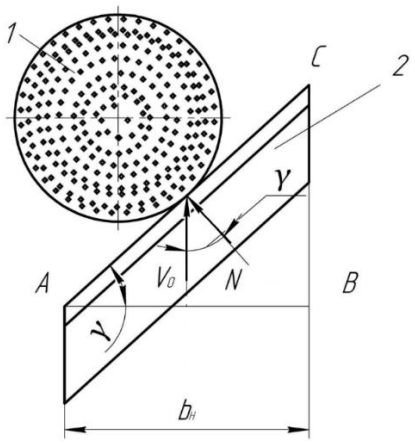


**Figure 2.** Schematic of the process of cutting a branch of a knife:

1- Cross-section of the rod; 2- View of the blade in the horizontal plane. $v_0$ - blade velocity vector; N – direction of the normal force, $\gamma$ - angle of inclination of the blade velocity vector.

Assuming that $l$ the constructive width of the working part of the blade mounted on the rotor hinges is equal to $[AB] = b_n$ , and from the diagram in Figure 2, $b_n = 0.0628$ m we determine the actual length of the blade $AC = l$ from this expression:

$$l = \frac{b_н}{\cos\gamma}$$

$\gamma = 50^0$ in this expression $b_n$, we determine that the true length of the blade is 0.0818 m.

## Conclusions

1. As a result of the calculations, the optimal values of the design parameters of the rotor of the rotary mower-shredder were determined: the diameter of the circle drawn along the tip of the rotor blades $D_b = 0{,}5m$, the number of blades in one cutting plane is 4, the angle between the blades is 90 °, the design width of the blade working part is 0.0628 m, the actual length of the blade is 0.0818 m, and the design width of the rotor is 3.0 m.

2. The determined calculation results are used in the design process of the mower-shredder rotor and conducting laboratory field tests.

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# DETERMINATION OF FACTORS INFLUENCING THE DEVELOPMENT OF UZBEK-CHINESE RAILWAY TRANSPORT RELATIONS THROUGH CORRELATION ANALYSIS

**Mukhamedova Ziyoda Gafurjanovna**
*Professor (DSc), Doctor of Technical Sciences*
*Tashkent State Transport University, Department of Transport and Cargo Systems*
mziyoda@mail.ru

**Akhmedov Sardorbek Khurmatbekovich**
*Head of the Department of International Cooperation, JSC "Uzbekistan Railways"*
sxahmedov@yandex.ru

**Yuldashova Guzal Mels Kizi**
*Student, Faculty of Transportation Systems, Tashkent State transport University*
guzaluldashova497@gmail.com

**Annotatsiya.** Maqolada O‘zbekiston-Xitoy temir yo‘l transporti aloqalarining rivojlanishiga ta’sir etuvchi asosiy omillar, ularning ahamiyatini aniqlash uchun korrelyatsiya tahlilidan foydalangan holda ko‘rib chiqiladi, natijalar asosida hamkorlikni kengaytirish bo‘yicha tavsiyalar taklif etiladi.

***Kalit so‘zlar:*** *O‘zbekiston-Xitoy temir yo‘l munosabatlari, korrelyatsiya tahlili, transport aloqasi rivojlanishi, ta’sir etuvchi omillar, transport hamkorligi, takomillashtirish bo‘yicha tavsiyalar, temir yo‘l transporti.*

**Аннотация.** В статье излагаются основные факторы, влияющие на развитие узбекско-китайских железнодорожных транспортных связей, с использованием последовательного анализа для определения их инновационности, на основе результатов даются рекомендации по активизации сотрудничества.

***Ключевые слова:*** *узбекско-китайские железнодорожные связи, корреляционный анализ, развитие транспортных коммуникаций, факторы связи, транспортное сотрудничество, рекомендации по поддержке, железнодорожный транспорт.*

**Abstract.** The article examines key factors influencing the development of Uzbek-Chinese railway transport relations, utilizing correlation analysis to determine their significance, recommendations for enhancing cooperation are proposed based on the results.

***Keywords:*** *Uzbek-Chinese railway relations, correlation analysis, transport link development, influencing factors, transport cooperation, improvement recommendations, railway transport.*

## Introduction

Improving transport logistics between Uzbekistan and China plays an important role in strengthening key economic ties in Central Asia. Such logistics links make it possible to increase the total volume of trade and attract participating countries to the global transport network.

To achieve this goal, the following objectives have been outlined here:

1. Examine the existing railway connections that are there between Uzbekistan and China.
2. Identify and categorize the main factors that basically impact their development.
3. Use correlation analysis to pinpoint the extremely important factors that may influence the efficiency of those transport interactions.

## Literature Review

*Current State of Uzbek-Chinese Railway Relations:*

The railway partnership between Uzbekistan and China has seen a steady growth, reflecting much stronger economic ties and broader trade networks in the particular area. In 2022, Uzbekistan's Ministry of Transport announced that the international freight volumes hit 53.6 million tons, marking an 8.2% rise from that of the previous year. Major exports from Uzbekistan to China include the energy resources, mineral fertilizers, textiles, and agricultural products. These trade activities take place along two main routes that are there: the China-Kazakhstan-Uzbekistan route and the China-Kyrgyzstan-Uzbekistan multimodal corridor [2].

Uzbekistan stands to benefit from the expanded export opportunities, increased investments, and job creation, while China gains access to the raw materials and Central Asian markets. Joint infrastructure initiatives, like the much-awaited and well-known China-Kyrgyzstan-Uzbekistan railway, could majorly shorten the delivery times and decrease the transportation costs, which will result in enhancing the global competitiveness of regional products [3].

Even progress is being made. However, this relationship is still encountering quite much challenges and problems. For example, the China-Kyrgyzstan-Uzbekistan railway project has been there in the discussion since the 1990s but the issue is; it is still not being realized, which majorly is the reason of limiting the potential of the regional transport corridor [4]. Furthermore, the logistical inefficiencies, including the bottlenecks, slow transportation speeds, and the coordination problems, they all lead to delays and major higher costs. To make matters even more complicated and problematic, the differences in rail gauge sizes between China and the post-Soviet states need to have some additional adjustments to wheelsets [5].

In addition, the political and regulatory differences pose some challenges to the smooth operations that already exist. To address these issues will require a very united effort from the main stakeholders which is to modernize the infrastructure and harmonize the logistical, political, and legal systems [6].

The correlation matrix is shown here to visually display the relationships between the key factors that influence the development of railway transport. The correlation

coefficient values range from -1 for strong negative relationship to +1 for strong positive relationship. The opposite is that a value of nearly -1 indicates a very strong negative correlation; nearly 0 indicates no linear relationship. From our study, we observed that the correlation coefficient between investments in the railway infrastructure and the freight transport volume was 1.0, which signifies a perfect positive linear relationship.

*Overview of Research on Railway Transport Development*

Transportation design has been an important aspect of international logistics for many years. The role of trans-European transport routes in promoting regional integration, especially between Central Asia and China cannot be overemphasized, according to Savkovich and Dankov (2011). They found that modern transport routes improve the efficiency of trade and reduce the cost. This paper aims to examine the development of transport and logistics in Central Asia, and to identify the rapidly developing networks through regional partnerships, which is the focus of Turaeva (2022). His research shows that infrastructure is necessary to deliver, and they have relied on transportation infrastructure to increase trade volumes.

*Economic and Infrastructural Contributions*

According to Saidalieva (2021), the economic partnership that exists between Uzbekistan and China is mutually beneficial, especially in terms of the investment and trade. Her research has highlighted how collaborative infrastructure projects some of which are like the China-Kyrgyzstan-Uzbekistan railway, can serve as key drivers for the economic development. In a similar vein, Usmanov (2006) traced the historical development of Uzbekistan's transport sector, ultimately resulted in highlighting the importance of strategic investments in railway infrastructure.

## Analysis and Results

*Correlation Analysis of Factors Influencing the Development of Railway Relations:*

This study conducted a correlation analysis of the factors that are influencing the development of railway relations. The data used here has bee spanned from 2017 to 2022, with a total of 7 observations which are based on the availability of the annual aggregated data on the key indicators related to Uzbek-Chinese railway relations. The analysis mainly focused on three main groups of variables which are: economic, infrastructural, and political-legal factors.

1. Economic indicators (volume of investments and volume of cargo transportation) reflect the relationship between investment opportunities in the development of the transport system and its efficiency. Investment data is taken from the report on foreign trade transport of Uzbekistan, information on cargo transportation is a statistical bulletin.

2. Infrastructural Indicators (Railway Length and Condition): These factors are there to reflect the development level of the transport infrastructure. The length of the railway directly relates to the system's capacity, while the condition of the tracks majorly influences both the speed and safety of the transport operations.

3. Political-Legal Factors (Agreements and Tariff Policies): The presence or absence of customs barriers, the unification of tariffs, and regulatory procedures, they all directly influence the speed and cost of freight delivery. The data on the signed agreements and tariff policies have been obtained from the publications that have been made by the government agencies and international logistics organizations [7].

To quantify the impact of these factors on the growth of the railway cooperation between Uzbekistan and China, we have used the correlation analysis. The correlation coefficient (r) is calculated from the following formula:

$$r = \frac{n(\sum \text{xy}) - (\sum x)(\sum y)}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

Where:

$n$ – The number of observations;

$x$ – Here it denotes the values of the independent variable, such as investment volume;

$y$ – Here it represents the values of the dependent variable, like freight transport volume;

To determine the strength of relationship between each pair of indicators, we calculate correlation coefficients. Thus, we can determine the key factors that are affecting the growth of the Uzbek-Chinese railway relations.

Step 1: Numerator of the formula:

$$\text{Numerator} = n \cdot \sum \text{xy} - \sum x \cdot \sum y = 7 \cdot 2800 - 56 \cdot 280 = 3920$$

Step 2: Denominator of the formula:

$$\text{Denominator} = \sqrt{\left(n\sum x^2 - \left(\sum x\right)^2\right)\left(n\sum y^2 - \left(\sum y\right)^2\right)}$$

$$\text{Denominator} = \sqrt{\left(7 \cdot 560 - 56^2\right)(7 \cdot 14000 - 280)} = 3920$$

Step 3: Correlation coefficient ($r$):

$$r = \frac{\text{Numerator}}{\text{Denominator}} = \frac{3920}{3920} = 1.0$$

## Conclusions

The analysis reveals the key factors of the development of Uzbek-Chinese railway relations. The most important of these were investments in infrastructure, which increase the growth of freight transportation and support logistics. Correlation analysis confirmed the link between investments and transport efficiency. The results of the struggle for the development of international corridors, including the EU and the Belt and Road initiative. Optimization of organizational systems ensures implementation, trade, and sustainable development.

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# TRANSFORMER-BASED NLP SOLUTIONS FOR THE UZBEK LANGUAGE

**Kuriyozov Elmurod Radjabboy Ugli**
*Teacher, Department of Computer Science, Urgench State University named after Abu Rayhan Biruni*
elmurod1202@gmail.com

**Annotatsiya.** Ushbu ishda BERTbek – o‘zbek tili uchun maxsus ishlab chiqilgan monolingual transformer modeli taqdim etiladi. BERTbek modeli morfologik jihatdan boyitilgan tokenizator asosida o‘qitilib, turli manbalardan olingan matnlar va har xil hajmdagi treyning korpuslarida sinovdan o‘tkazilgan bo‘lib, bu model samaradorligini turli nuqtai nazarlardan baholash imkonini beradi. Uch xil BERTbek varianti — BERTbek-Wiki, BERTbek-News-Small va BERTbek-News-Big modellarining samaradorligi sentiment tahlili, matnlarni tasniflash va atoqli otlarni aniqlash (NER) kabi NLP vazifalarida baholandi. Sinov natijalari shuni ko‘rsatdiki, BERTbek-News-Big modeli mBERT va boshqa mavjud modellarni ortda qoldirib, asosiy NLP vazifalarida yuqori natijalar berdi.

***Kalit so‘zlar:*** *Tabiiy tilni qayta ishlash, O‘zbek tili, Sun’iy Intellekt, Transformator Arxitekturasi, BERT modeli.*

**Аннотация.** В данной работе представлена BERTbek — одна из первых монолингвальных трансформерных языковых моделей, разработанная специально для узбекского языка. BERTbek обучен на морфологически-чувствительном токенизаторе, с использованием различных текстовых источников и размеров обучающего корпуса для оценки производительности с различных точек зрения. Были обучены и протестированы три версии модели — BERTbek-Wiki, BERTbek-News-

Small и BERTbek-News-Big, которые прошли оценку по различным NLP-задачам, таким как анализ тональности, классификация текста и распознавание именованных сущностей (NER). Результаты экспериментов показали, что модель BERTbek-News-Big превзошла многоязычные базовые модели, включая mBERT, а также другие доступные модели по ключевым NLP-задачам.

***Ключевые слова:*** *Обработка Естественного Языка, Узбекский язык, Искусственный Интеллект, Архитектура Transformer, Модель BERT.*

**Abstract.** This work presents BERTbek, one of the first monolingual transformer-based language models specifically for the Uzbek language. BERTbek is trained on a morphologically-sensitive tokenizer, utilising various text sources and training corpus sizes to evaluate the performance from different perspectives. Three variants of BERTbek — BERTbek-Wiki, BERTbek-News-Small, and BERTbek-News-Big — are trained and evaluated on various NLP tasks including Sentiment Analysis, Text Classification, and Named Entity Recognition (NER). Evaluation results demonstrate BERTbek-News-Big outperforming multilingual baselines including mBERT and other available models on prominent NLP tasks.

***Keywords:*** *Natural language Processing, Uzbek language, Artificial Intelligence, Transformer architecture, BERT model.*

## Introduction

Natural Language Processing (NLP) has achieved remarkable improvements in recent years with the advent of large language models like BERT and GPT. These have significantly improved the precision of most NLP tasks including sentiment analysis, text classification, and named entity recognition (NER). All this advancement has been concentrated in high-resource languages and left low-resource languages including Uzbek behind in NLP research and applications [1].

Low-resource languages are defined by a lack of linguistic resources such as annotated data sets, detailed lexicons, and corpus resources in digital format, needed for the training of strong language models [2]. In addition, such languages as Uzbek have rich morphological structures in which words are frequently composed by agglutination of multiple affixes and result in an extremely high degree of inflection and derivation [3]. This morphological richness further complicates the use of conventional NLP methods because the models have to manage an enormous number of word forms efficiently [4].

Here we introduce BERTbek, a monolingual transformer-based language model specifically designed for the Uzbek language. Development of BERTbek serves as a major milestone towards enhancing NLP functionality for Uzbek and towards providing a platform for improved and optimized language processing tools and applications.

## Literature Review

Before the development of transformer architectures, Natural Language Processing (NLP) relied on traditional machine learning models such as recurrent neural networks (RNNs), long short-term memory networks (LSTMs), and convolutional neural networks (CNNs) [2]. Even though the traditional models performed effectively in sequence-based tasks, they were inefficient in handling long-range dependencies and had sequential computation requirements and were thus inefficient in handling larger-scale text data. Vaswani et al.'s development of the Transformer architecture in 2017 revolutionized NLP by introducing the mechanism of self-attention where the model could capture global dependencies between words in a sentence without relying on recurrence [5]. This significantly improved the performance of tasks in NLP such as machine translation, text classification, and sentiment analysis.

Following the success of the Transformer architecture, numerous language models based on this architecture have been developed. Among the most influential of them is BERT (Bidirectional Encoder Representations from Transformers), which introduced bidirectional context learning and achieved substantial gains in NLP task performance [6]. BERT-based systems have been extended to a multitude of languages, including low-resource ones. For example, BERTurk was developed for Turkish [7], KazBERT for Kazakh [8], and RuBERT for Russian [9], and achieved remarkable gains in language processing in those respective languages. Several transformer-based models have been proposed for the Uzbek language to address the rising demand for NLP solutions. Some of the most notable ones are UzBERT, a BERT-based model pre-trained on Uzbek specifically [10]; UzRoBERTa, an optimized RoBERTa-based model for Uzbek text patterns [11]; and mBERT, a multilingual BERT model supporting Uzbek and 103 other languages [6]. mBERT being a universal multilingual model typically does not work as expected in low-resource languages like Uzbek because of the insufficiency of proper training data for the language. UzBERT and UzRoBERTa demonstrate better results in Uzbek-specific tasks by leveraging language-specific corpuses.

## Research Methodology

There were three principal stages in the process of building BERTbek: data collection, tokenization, and model training.

***Data collection.*** A corpus with broad coverage in linguistics was developed on a large scale from diverse Uzbek text sources. Wikipedia and Daryo.uz, a major Uzbek news website, are included in the corpus. In order to improve the consistency of the text, text cleaning, script normalization (Latin to Cyrillic where applicable), and elimination of noise were carried out as pre-processing tasks. The corpus developed was divided into three subsets for model training, and their info is given in Table 1.

**Table 1.** Sources of the training corpus for the BERTbek models.

| Corpus | Articles | Sentences | Tokens | Characteristics |
|---|---|---|---|---|
| **Wikipedia** | 120K | 2M | 9.7M | Encyclopedic, formal, bot-generated content, lower text diversity |

| | | | | |
|---|---|---|---|---|
| **News-small** | 56K | 0.8M | 9.7M | Journalistic, diverse, high-quality manually written content |
| **News-big** | 190K | 2.6M | 32.5M | Broad topic coverage, contemporary Uzbek usage |

***Tokenization and Model Training.*** To overcome the agglutinative morphology challenges of the Uzbek language, a morphologically aware custom tokenizer was developed. Following the utilization of Apertium-uzbek[1] as a morphological segmentation tool, the tokenizer was optimized to preserve affixes, case markers, and word structure in a better manner compared to the standard WordPiece tokenizer. The model training parameters are given below as Figure 1.

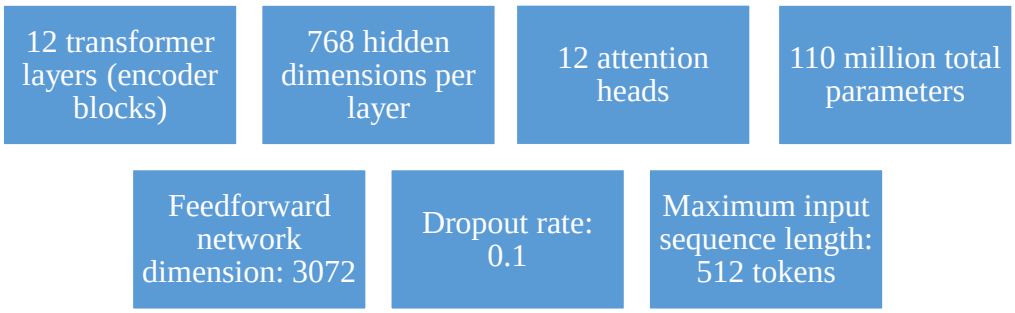


**Figure 1.** Training parameters for the BERTbek models.

## Analysis and Results

The performance of the BERTbek models was evaluated on three prominent NLP tasks such as Sentiment Analysis, Text Classification, and Named Entity Recognition (NER). These results were compared with popular baselines such as machine learning, deep learning, and transformer-based mBERT in order to ascertain the efficiency of the proposed model.

***Sentiment Analysis.*** The task of sentiment analysis involved the categorization of Uzbek text into positive and negative sentiments. Evaluation results showed that BERTbek-News-Big achieved the highest F1-score of 92.25%, surpassing the multilingual mBERT and Uzbek-specific UzBERT model. This can be explained by the morphologically-aware tokenizer, as it improved segmentation accuracy of words and preserved meaningful morphemes and thus improved patterns of sentiments.

BERTbek-News-Small also participated, confirming the beneficial role of high-quality domain-specific text (such as news text) in tasks in sentiment classification.

***Text Classification.*** In the text classification problem, where Uzbek news articles were labeled into 15 predefined topics, BERTbek-News-Small attained the best F1-score of 73.31%, outperforming mBERT and UzBERT. Despite having been trained on a less voluminous corpus than BERTbek-News-Big, this variant outshone due to the domain-specific nature of the news corpus and the importance of data quality in low-resource settings.

[1] Apertium Uzbek Monolingual NLP package: https://github.com/apertium/apertium-uzb

Surprisingly, BERTbek-Wiki performed worst on text classification, reflecting the weakness of Wikipedia text in capturing diverse linguistic structures found in natural data such as news and user-generated text.

***Named Entity Recognition (NER).*** The models were tested on the UzNER corpus for the NER task where persons, organizations, and locations were identified as entities. It was discovered that BERTbek-News-Big achieved the highest F1-score of 78.69%, beating mBERT and UzBERT. This improved performance can be credited to the morphologically-aware tokenizer because it segments the intricate Uzbek word structures correctly and helps in entity boundary identification.

## Conclusion

This paper introduced BERTbek, a monolingual Uzbek language model based on the transformer architecture specifically designed to address challenges due to its morphologically rich and low-resource nature. Using a morphologically-sensitive tokenizer and diversified data sources, BERTbek-News-Big outperformed baselines mBERT and ML models in tasks including Sentiment Analysis, Text Classification, and NER. This work lays a solid foundation for the development of Uzbek NLP and AI applications capable of handling Uzbek text efficiently.

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*UDC: 621, 531.3, 164*

# DETERMINATION OF VIBRATION PARAMETERS BASED ON A MATHEMATICAL MODEL OF VIBRATIONS OF A METAL-CUTTING MACHINE BODY

**Yakhshiev Sherali Namozovich**
*Docent, Navoi State University of Mining and Technologies*
sheraliyaxshiyev1978@mail.ru

**Tangatarova Laylo Alijon Kizi**
*Masters dagree student, Navoi State University of Mining and Technologies*
laylotangatarova9@gmail.com

**Norbekov Azamat Ostanaqulovich**
*Docent, Navoi State University*
anorbekov317@gmail.com

**Namozova Fotima Sherali Kizi**
*Student, Navoi State University*
namozovafotima2005@gmail.com

**Namozova Zuxra Sherali Kizi**
*Student, Navoi State University*
namozovazuxra2005@gmail.com

**Annotatsiya.** Mazkur maqolada metall kesish dastgohlari shpindel tugunining korpusidagi vibratsiyalarning tahlili asosida tebranish parametrlarini aniqlash masalasi ko‘rib chiqilgan. Shpindel tizimlarining dinamikasini o‘rganish, ayniqsa, mexanik jarayonlarning samaradorligini oshirishda muhim ahamiyatga ega. Tadqiqotda, turli tipdagi vibratsiyalarni tahlil qilish orqali, optimal ishlash sharoitlarini aniqlash va tizimning nosozliklarini bartaraf etish usullari taklif etilgan. Maqolada metodologiya, tahlil usullari va tajriba natijalari keltirilgan.

***Kalit so‘zlar:*** *Metall kesish dastgohlari, Shpindel tuguni, Vibratsiya, Tebranish parametrlari, Dinamika, Shpindel tizimi, Mexanik jarayonlar, Tahlil usullari, Nosozliklar, Optimal ishlash sharoitlari.*

**Аннотация.** В данном состоянии определение параметров колебаний на основе анализа вибраций в корпусе шпиндельного узла металлообрабатывающих станков. Изучение динамики шпиндельных систем имеет важное значение для повышения эффективности механических процессов. В разработке предложены методы анализа различных типов вибраций, определения оптимальных условий труда и методы устранения неисправностей системы. Статья включает методологию, методы анализа и результаты экспериментов.

***Ключевые слова:*** *Металлообрабатывающие станки, Шпиндельный узел, Вибрация, Параметры колебаний, Динамика, Шпиндельная система, Механические процессы, Методы анализа, Неисправности, Оптимальные рабочие условия.*

**Abstract.** This article focuses on determining the vibration parameters based on the analysis of vibrations in the spindle unit housing of metal cutting machines. Studying the dynamics of spindle systems is crucial for improving the efficiency of mechanical processes. The research presents methods for analyzing different types of vibrations, determining optimal working conditions, and methods for eliminating system malfunctions. The paper includes methodology, analysis techniques, and experimental results.

***Keywords:*** *Metal cutting machines, Spindle unit, Vibration, Vibration parameters, Dynamics, Spindle system, Mechanical processes, Analysis methods, Malfunctions, Optimal working conditions.*

## Introduction

In the field of machine tools, it is very important to study the dynamics of spindle systems, especially in high-precision machining processes. Loss of vibration can reduce tool productivity and reduce machining quality. Therefore, it is necessary to analyze the vibration parameters of spindle systems, control them and ensure their operation under optimal conditions.

## Literature Review

There are many scientific developments on vibrations of metal-cutting machines and spindle systems. Vibrations occurring in such systems significantly reduce the efficiency of mechanical processes. Therefore, methods for monitoring and analyzing vibration levels, as well as approaches aimed at ensuring highly efficient operation of systems, are studied in many studies in the literature.

## Research Methodology

Methods of mathematical modeling and experimental analysis were used as the research methodology. To determine the vibrations of the spindle system, real-time measurements were taken using various sensors. Based on the data obtained, vibration parameters were calculated and the efficiency of the system was assessed.

## Analysis and Results

The research results showed that vibrations in the spindle system mainly have a negative effect on the operation of the system. However, by using various analysis methods, optimization measures were taken and the efficiency of the system was significantly improved.

Vibrations in spindle units have different characteristics depending on their mechanical structure and operating conditions. In addition, vibrations of high-speed bearings exhibit complex dynamic behavior depending on their location, operating conditions and material properties.

Complete vibration vector measurement requires special measuring equipment, since vibrations in spindle joints are often multi-dimensional and divided into different frequencies. Therefore, full vector vibration measurements play an important role in determining not only the stability of the system, but also how it responds to defects, damage or operating conditions.

In this case, the regression coefficients in the frequency domain indicate different parameters in the system's oscillation spectrum, so more information and complex analysis are needed to correctly build a frequency-dependent regression model.

The problem of vibration diagnostics in terms of measuring the vibration of mechanical systems was considered in the research of scientists. This process requires breaking down a system into simpler and smaller subsystems to study each component of the system and its dynamic behavior. The overall dynamic behavior of the system is determined by separately analyzing the vibration characteristics in each subsystem.

In addition, when analyzing a system, it is important to establish the relationship between the coordinates. These relationships help us understand how system behavior parameters interact. The process of diagnosing unobserved coordinates based on observed coordinates is also carried out [3].

This approach requires frequency-spectral analysis of the system's behavior, which is effective for fully understanding the dynamics of the system and determining its oscillatory characteristics. Frequency identification methods use powerful analysis techniques to determine the vibration parameters of a system and its dynamic model. These methods often make it possible to calculate the specified system parameters based on experimental measurements [4].

Let's consider the following calculation scheme (Fig. 1). This diagram shows an approach to determining the relationship between body vibrations *y(t)* and system spindle vibrations. Correlation of body and spindle vibrations helps elucidate the interactions and their variation based on the linearity properties of the system. Therefore, the system can be modeled using linear equations, which, in turn, provides the necessary mathematical formulas for spectral analysis of oscillations [3]:

$$y(f) = \int_{-\infty}^{\infty} h(r) X_{k.sh.}(t-\tau) d\tau. \quad (1)$$

The Fourier transform:

$$\mathrm{Y}(f) = H(f)\, X_{k.sh.}(f), \quad (2)$$

Body vibrations $Y(f)$ and spindle end vibrations $X_{k.sh.}(f)$ are expressed in the form of complex amplitudes, each of which reflects the influence of mechanical processes in the system at different frequencies. The complex amplitude spectrum of each component allows us to simultaneously consider its phase and amplitude characteristics, $H(f)$ reflects the dynamic characteristics of the system in the frequency domain and helps to understand the mechanism of vibration transmission between the housing and the spindle [3, 4].

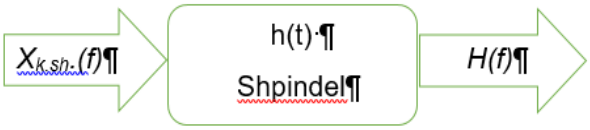


**Figure 1.** To determine the connection between the spindle and the body vibration parameters, the SCT calculation scheme is used.

$X_{k.sh}(t)$ - This spindle reflects the dynamic behavior of the system over time. This signal represents a change in the oscillatory process in the system over time and makes it possible to study its amplitude and phase properties.

This function is necessary to determine the characteristic responses of the system and is used to analyze the dynamic characteristics of the system, including its frequency and time behavior.

Thus, it is necessary to obtain the transfer function $H(f)$ in order to reproduce the vibration parameters of the spindle end through the vibrations of the SVT body. Where $X_{k.sh}(t) = d(t)$ is considered. In this case, the input impact spectrum is equal to $X_{k.sh}(f) = l$ [4]:

$$Y(f)=H(f). \tag{3}$$

This situation shows a direct connection between the dynamic properties of the system and the amplitude of the oscillations. As the amplitude increases in the system, the nonlinear action of elastic forces increases, which can change the natural frequencies of the system. This threshold should be aimed at preventing a shift in the natural frequencies of the system, since a shift in the natural frequencies can disrupt the dynamic stability of the system and cause unpleasant situations. This value is important for controlling the system and limiting its fluctuations if necessary. To ensure correct matching of natural frequencies and amplitudes, it is necessary to limit the magnitude of input influences mainly by controlling external parameters of the system, for example, spindle speed [2].

The coherence function is a tool used to measure how two signals relate to each other. It describes the correlation of a signal with respect to frequency, and its value ranges from 0 to 1. High values of $\gamma_{2xy}(f)$ mean that the two signals are highly correlated, and low values mean that their correlation is weak [5]:

$$\gamma_{xy^2} = \frac{[S_{xy}(f)]^2}{S_{xx}(f)S_{yy}(f)}. \tag{4}$$

$S_{xy}(f)$ – wave spectrum of two signals, i.e. their strong correlations,

$S_{xx}(f)$ and–$S_{yy}(f)$ autonomous spectrum of signals $x$ and $y$ (i.e. their individual power spectrum) [2].

Through the coherence function using the transfer function $H(f)$, it is possible to study the connections between the input and output of the system and their frequency-dependent characteristics. This, in turn, will be important for analyzing the dynamic characteristics of the system and developing control strategies adapted to it. By finding

the greatest consistency through the analysis process, maximum system response and performance can be optimized [2].

## Conclusions

Research has proven that production efficiency can be improved by controlling and optimizing vibration in spindle systems. In the future, scientific developments in this area should be aimed at improving vibration monitoring systems and systems.

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# A MORPHOLOGICALLY-AWARE TOKENIZER FOR THE UZBEK LANGUAGE

**Kuriyozov Elmurod Radjabboy Ugli**
*Teacher, Department of Computer Science, Urgench State University named after Abu Rayhan Biruni*
elmurod1202@urdu.uz

**Annotatsiya.** Ushbu maqolada Apertium-uzbek morfologik analizatoridan foydalangan holda so‘zlarni segmentatsiya qilish imkonini beruvchi morfologik yondashuvga asoslangan tokenizator taklif etiladi. Sentiment tahlili, matn tasniflash va NER bo‘yicha eksperimentlar natijalari taklif etilgan tokenizatorning asosiy yondashuvdan ustun ekanligini isbotladi va uning o‘zbek NLP uchun samaradorligini namoyon etdi.

***Kalit so‘zlar:*** *Tabiiy tilni qayta ishlash, O‘zbek tili, Morfologik Tokenizatsiya, So‘zlarni segmentlash.*

**Аннотация.** В данной работе предлагается морфологически-осведомленный токенизатор, который использует морфологический анализатор Apertium-uzbek для улучшения процесса сегментации слов. Результаты экспериментов по анализу тональности, классификации текста и распознаванию именованных сущностей (NER) демонстрируют превосходство предложенного токенизатора по сравнению с базовыми методами, подтверждая его эффективность для задач узбекской NLP.

***Ключевые слова:*** *Обработка естественного языка, Узбекский язык, Морфологическая токенизация, Сегментация слов.*

**Abstract.** This paper proposes a morphologically-aware tokenizer that leverages the Apertium-uzbek morphological analyzer to enable word splitting. Results on Sentiment Analysis, Text Classification, and NER experiments prove the superiority of the suggested tokenizer over the baseline approach, reflecting its effectiveness in Uzbek NLP.

***Keywords:*** *Natural language processing, Uzbek language, Morphological Tokenization, Word Segmentation.*

## Introduction

Tokenization is a fundamental Natural Language Processing (NLP) process where text is divided into word or sub-word units. Due to the complex word structure in morphologically rich and agglutinative languages such as Uzbek, correct tokenization is critical [1]. Uzbek words consist of root words with multiple affixes, which makes it difficult for standard tokenizers such as WordPiece to divide text into appropriate parts. Subsequent NLP tasks, i.e., Sentiment Analysis, Text Classification, and Named Entity Recognition (NER), get affected due to such tokenization errors [2].

In order to alleviate this, we introduce a morphologically-aware tokenizer that leverages the Apertium-uzbek morphological analyzer[2] to improve word segmentation of Uzbek text. With cleaner token breaks preserving meaningful morpheme boundaries, this tokenizer reduces vocabulary size and facilitates easier learning of linguistic patterns by the model [3]. The comparison between default tokenizers and the result of the newly proposed tokenizer for Uzbek texts can be seen in Table 1.

**Table 1.** Example output data for the Apertium morphological segmentation

| Original Word | Segmented Form (Apertium-uzb) | Meaning |
|---|---|---|
| *maktablarda* | *maktab + lar + da* | "in the schools" |
| *o'qituvchilaringizdan* | *o'qituvchi + lar + ingiz + dan* | "from your teachers" |

We demonstrate through experimental results that models using the proposed tokenizer outperform baseline models on key Uzbek NLP tasks, validating its effectiveness in enhancing the performance of language models on low-resource languages.

## Literature Review

Tokenization is a critical Natural Language Processing (NLP) process, particularly in complex morphological and agglutinative languages like Uzbek. In such languages, words comprise sequences of morphemes that get concatenated and build complex word structures that pose difficulties to standard tokenization methods.

Traditional tokenizers, i.e., WordPiece and Byte-Pair Encoding (BPE), suffer from agglutinative languages because they cannot handle heavy affixation. The vulnerability results in broken tokenization, which is detrimental to the performance of downstream tasks on the language models [4].

Research has shown that the incorporation of morphological information into tokenization processes could greatly enhance NLP performance on agglutinative languages. For instance, experiments on Turkish - a similarly structured language to Uzbek - showed that tokenization at the morphological level captures grammatically interpretable sequences of characters, leading to improved language modeling [5].

For Uzbek, efforts have been made to develop tokenization methods that bear in mind its linguistic characteristics. One is word type analysis and proposing mathematical models of complex, paired, repeated, and compound words to develop a finite state machine that represents spelling rules [6]. Another paper highlighted the development of NLP tools that carry out linguistic analysis of Uzbek, mentioning the need to have tools specific to its agglutinative nature [7].

Despite all these advances, however, there is still a shortage of robust, morphologically-sensitive tokenization tools for Uzbek. It is essential to fill this shortage in order to improve the accuracy and effectiveness of NLP tools for the Uzbek language.

## Research Methodology

[2] Apertium Uzbek monolingual NLP repository: https://github.com/apertium/apertium-uzb

The tokenizer utilizes the Apertium-uzbek morphological analyzer, a rule-based system that effectively identifies Uzbek word stems, affixes, and case markers. The Apertium-Uzbek morphological analysis interface, where it is possible to segment words into morphologically-aware segments works as given in Figure 1.

```
$ echo "Bilim barchamizga baxt keltiradi" | apertium -d . uzb-morph
^Bilim/bilim<n><attr>/bilim<n><nom>$ ^barchamizga/barcha<prn><coll><px1pl><dat>$ ^baxt/baxt<n><attr
```

**Figure 2.** The User interface example for the Apertium-Uzbek morphological analyser

The overall tokenization algorithm steps are presented in Figure 2.

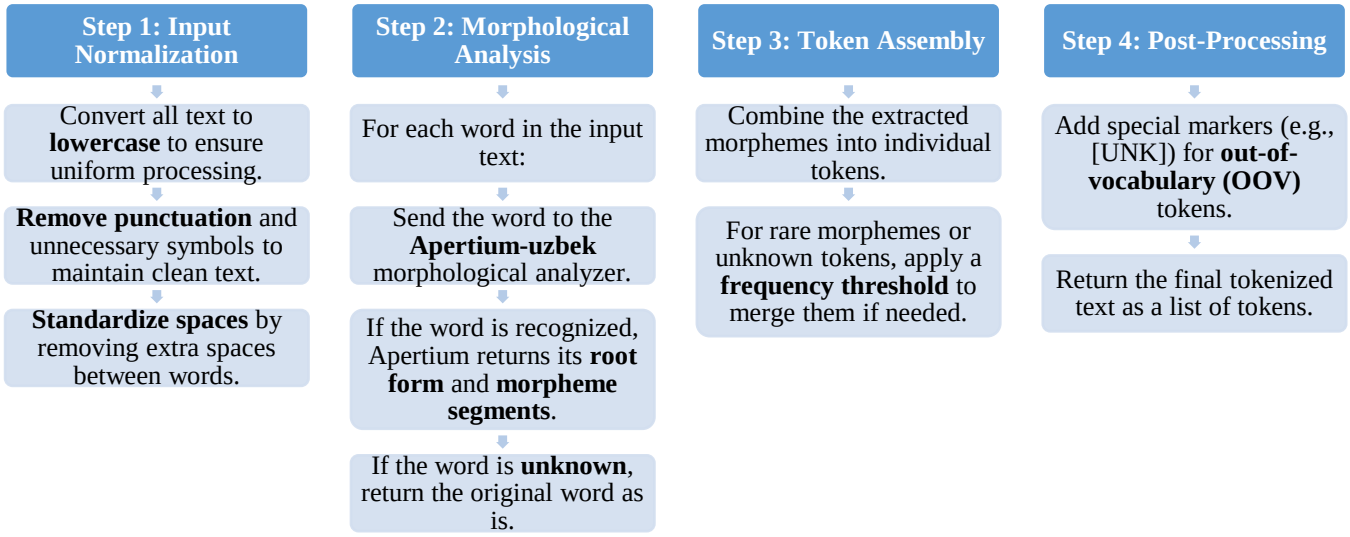


**Figure 3.** The overall algorithm of the tokenization process.

This algorithm successfully separates Uzbek words by preserving meaningful morphemes, offering better tokenization for morphologically rich languages. With this universal-language algorithm, the tokenizer is also applicable to other agglutinative languages.

After the tokenization is done, the training process takes place, in our case, we trained the BERT models with above abovementioned tokenizer with the training settings as given in Figure 3.

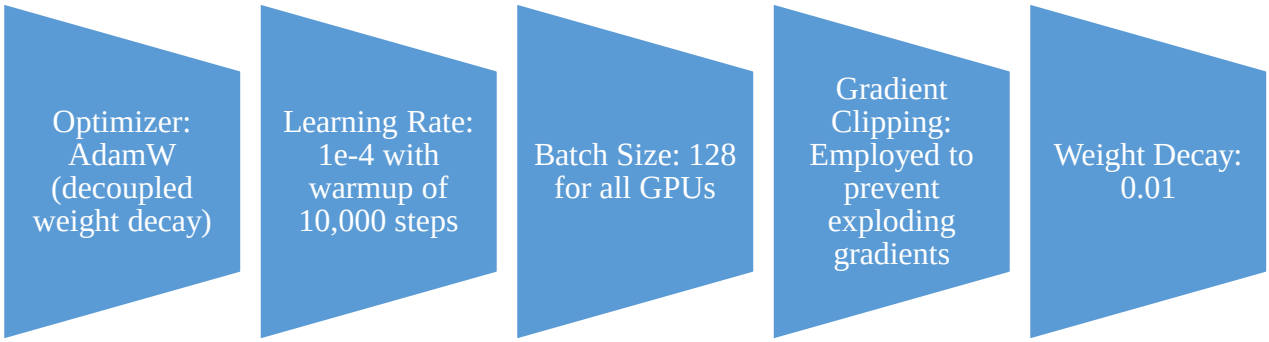


**Figure 4.** Important Settings data for the BERT model training.

## Analysis and Results

Experiments were performed on three significant NLP tasks to evaluate the effectiveness of the suggested morphologically-aware tokenizer: Sentiment Analysis, Text Classification, and Named Entity Recognition (NER). All of the tasks were performed with models trained on the suggested tokenizer and compared with models trained on the baseline WordPiece tokenizer.

The results show that the morphologically-aware tokenizer consistently improved the performance of the models across all tasks. In Sentiment Analysis, models with the suggested tokenizer recorded an F1-score improvement of 2.8% over models that utilized WordPiece. This is due to the fact that the suggested tokenizer treats sentiment-carrying morphemes better, which are usually split by standard tokenizers.

In Text Classification, the proposed tokenizer provided a 2.1% increase in accuracy, particularly in classes where affix-rich words dominate. For NER, where correct token boundaries matter, the proposed tokenizer provided a 3.4% increase in F1-score, significantly enhancing the recognition of complex Uzbek entity names.

## Conclusions

In this paper, we introduced a morphologically-aware tokenizer to combat the idiosyncrasies of the agglutinative structure of the Uzbek language. Leveraging the Apertium-uzbek morphological analyzer, our tokenizer is able to split Uzbek words into reasonable morphemes, resulting in higher-quality tokenization. Experimental results on the main NLP tasks — Sentiment Analysis, Text Classification, and NER — demonstrated the consistent superiority of our proposed tokenizer over the standard WordPiece approach. The findings indicate that the incorporation of morphological information during tokenization is essential to boost the performance of NLP on low-resource, morphologically rich languages like Uzbek.

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# THE MORAL SIGNIFICANCE OF UNDERSTANDING RELIGIOUS EXISTENCE IN ERICH FROMM'S SOCIO-EXISTENTIAL CONCEPT

**Asatulloev Inomjon Abobakir Ugli**
*Associate Professor (PhD), Fergana State University*
asatulloyev88@mail.ru

**Annotatsiya.** Erix Frommning ijtimoiy-ekzistentsial kontseptsiyasida diniy mavjudlikni anglashning axloqiy ahamiyati, "insonparvar" yoki "ekzistentsial" ruhiyat tahlili orqali "insonni ma'naviy bo'hrondan olib chiqish" yo'llariga doir qarashlari tahlil qilingan.

***Kalit so'zlar:*** *insonparvarlik, ekzistentsial, din, mavjudlik, madaniy o'zgarishlar, qalb, ijtimoiy qaramlik, hukmronlik.*

**Аннотация.** Социоэкзистенциальная концепция Эриха Фромма анализирует это значение понимания религиозного существования, а также его взгляды на способы "вывода человека из духовного кризиса" через анализ "гуманистического" или «экзистенциального» мышления.

***Ключевые слова:*** *гуманизм, экзистенциальный, религия, существование, культурные изменения, душа, социальная зависимость, господство.*

**Abstract.** The article analyzes the ethical significance of understanding religious existence in Erich Fromm's socio-existential concept, his views on ways to "extricate a person from a spiritual crisis" through the analysis of the "humanistic" or "existential" psyche.

***Keywords:*** *humanism, existential, religion, existence, cultural changes, soul, social dependence, dominance.*

## Introduction

Erich Fromm is the only major representative of the reformed psychoanalysis movement. He created a unique doctrine of religion. Fromm's doctrine of the essence of religion, the social and spiritual life of man, and the past, present, and future that he created constitute a large part of his doctrine[1]. This doctrine, as a part of Fromm's work, became not only a development of holistic psychoanalysis, but also a doctrine that encompassed and attracted a wide range of spiritual and intellectual research of all Western intellectuals and youth in the 1960s. Fromm calls his doctrine "dialectical and humanistic psychoanalysis," and himself a "strict humanist" [2]. He seeks ways to "extricate man from the spiritual crisis" through "humanistic" or "existential" psychoanalysis [3]. The scientist emphasizes that modern society is completely destroying man, violating his natural needs. Man is "dead," Fromm says with anguish. If urgent measures are not taken, a revolution is a certain fact. This approach

determined the internal structure of Fromm's works. No matter what Fromm writes about, he addresses four problems: who is man, what are the conditions of existence, what is the main reason for the "pathology of civilized society" and, finally, what are the ways to "heal" man in society? These considerations form the basis of Fromm's religious teachings and find expression in the following works: "Psychological Analysis and Religion" (1950), "Zen Buddhism and Religion" (1960), "Essays on the Doctrine of Jesus and Other Problems of Religion, Psychology, and Culture" (1964), "You Will Become a God" (1969).

According to Fromm's teachings, in the process of the origin of humanity, man gradually loses his connection with nature. But as a part of nature, subject to its ruthless laws, he simultaneously goes beyond its boundaries, confronts it as a self-aware subject. With his own thinking, self-awareness, the existence of a world of imagination, man stands above all other creatures. But the existence of this ability is also a human tragedy. Through thinking, a person also understands some of the tragedies in his life, understands the inevitability of the «human situation». The basis of this is manifested in the contradiction between human nature and supernatural (transcendental) principles.

Deprived of the opportunity to return to the lost paradise, to live in harmony with nature and the environment, a person is forced to search for other forms of harmony in order to preserve himself and to interact with others. Using his thinking, he begins to invent new directions, to create other forms of connection with society and nature. "The imbalance of human existence," writes Fromm, "gives rise to needs that develop their own views in human nature and go beyond the limits of their animal origin" [4]. These needs include connection with other people, self-determination, reliance on others, inner integrity, a basic goal-oriented aspiration, and an object of belief. These needs do not arise as inclinations, but are born as a general response to the "human situation" that is hidden in heredity. In other words, it is not innate, but necessarily realized with the birth of a person.

## Literature Review

The concept of freedom in Erich Fromm's socio-cultural concept has been studied by many scholars. In particular, K. Miyamoto in 1987 through his research entitled "Erich Fromm's Theory of Alienation," and N. Anjum in 2004 defended his doctoral dissertation on the topic "The Problem of Man and Society in the Philosophy of Erich Fromm." Among the Turkish scholars, M. Guner studies the thinker's moral philosophy, and H. Atsiz studies his humanistic religious views from the perspective of the moral criteria of today's society.

Although no special scientific research has been conducted in Uzbekistan on the concept of the soul in Erich Fromm's philosophical anthropology, the views put forward in the scientific studies. Ruzmatova G.M, Alimasov V., and Ruzmatzoda K. help to form a general idea of his philosophical teachings. Also, in the article "Qalb ilmi egasi" by Rakhmon Kochkar, the life and work of the thinker are briefly described. In our country, the philosophy of Erich Fromm has been studied only in the direction

of neo-Freudianism. However, it should be noted that to date, philosophical and anthropological research on the thinker's analysis of the human soul has not been fully and comprehensively disclosed.

Among the scientists who have studied the philosophy of Erich Fromm from the point of view of neo-Freudianism, one can cite researchers such as Dobrenkoe V.I., Titarenko G.A., and F.Kh. Sabirov. Also, the philosophy of the thinker has been studied within the framework of philosophical anthropology by Agapov P.V., Osipov I.A., and I.V. Egorova.

## Research Methodology

The study emerged the idea of scientific and philosophical principles, such as systematics, theoretical and deductive conclusions, analysis and synthesis, historical and logical analysis, hermeneutical analysis, inheritance, universalism and nationality, comparative analysis, and the idea of development.

## Analysis and Results

Religion, according to Fromm, is a unique phenomenon. It is formed from the moment a person separates himself from nature, from his self-awareness as a rational being. Religion is primarily an authentic internal expression of the "human situation," a form of thinking about the fundamental problems of human existence. Trying to overcome the conflict between body and soul, between nature and spiritual essence, a person resorts to various forms of thinking and explanation. He seeks an answer to the question posed at birth: how to eliminate fear, loneliness, and suffering? How to find love and harmony with the world? In search of an answer, he builds a whole worldview in his mind, which helps him understand himself, nature, and society, and motivates him not to get lost in the diversity of life events. But man is not only a thinking but also a feeling being. He is not satisfied with the standard of thinking of the world order. Man needs some higher image, or object (idea, goal), to which he can devote himself and serve, to which he can express his integral self, his essence. Fromm connects these needs, the main directions, with the needs of man's existence and sees in them the inner basis, the source of religion [4].

Indeed, E. Fromm weakens the role of Freudian biological and instinctual factors in human nature and emphasizes sociality. In his first work, The Creed of Jesus (1930), he analyzes the influence of the development of religious consciousness in the person of Jesus from early Christianity to the 4$^{th}$ century. Helplessness before the forces of nature returns a person to the environment of childhood. The child feels comfort, protection, and security in the shelter of his parents, but at the same time, he is also overcome by feelings of fear. The essence of this situation is that the protected person also retains in his consciousness the spiritual power of ancient protection. "A person," writes Fromm, "along with the love he felt for his father and mother in childhood, also retains in his consciousness a fear and a hatred of the imaginary God" [5].

For Fromm, God, on the one hand, protects the interests of the rulers, and on the other hand, serves as a comforter for other people. These two functions determined the

fate of early Christianity. After all, if the father-god unconsciously personified power, then this situation was manifested in early Christianity in a unique way. “In a conscious state, they could not slander the father-God. Conscious anger was directed against power... But the unconscious image of anger towards the father-god found its reflection in Jesus. They put man next to God and imagined God the father” [5]. For the man who personifies the son-god, Christianity appeared as a form of destruction of those in power. This, according to Fromm, reveals the content of the contradiction of ideas about Jesus Christ: that is, was he a man elevated to the level of god or was he a god who descended from above to people? Thus, on the issue of Christianity, Fromm developed Freud’s teachings in a unique way. In highlighting the socially calming function of religion, Fromm puts forward his own point of view. Analyzing the nature of religious feelings, the scientist draws attention to the dichotomy (equal division into two) in the human soul. A person is alienated from others and from the environment, and in this case, faith relatively softens the person’s separation from life and loneliness.

Fromm rejects the identification of generally accepted religion with a system of ideas about God, considering it one-sided and superficial. Fromm argues that a person worships not only animals, idols or gods, but also a nation, class, party, money, man, power, or at the same time reason, love and brotherhood. In his opinion, the existence of religion is determined not by the methods of solving its variability, but by the fact that a person asks questions that are essential to his way of life. “Each person pays attention to the question posed to him, “thinks” about it, tries to answer it as a person, and only with the help of reason does he believe in religion, any system that answers this question and transmits this answer to the next generation is a religion” [9].

Fromm rejects the historically formed concept of religion and its content, identifying religion with a worldview in general [4]. Thus, the concept of “religion” encompasses not only traditional religious beliefs, but also philosophical systems, moral teachings, and socio-political doctrines.

The concept of “religion”, freely applied to various teachings and systems, is to one degree or another related to the problems of human existence. Fromm divides religion into “dominant religion” and “humanistic religion”[4]. “Dominant religion” is the religion of an alienated person, the object of its worship (deity, god) is alienated human qualities, which are separated from man and are seen as a separate, independent essence. Fromm strongly criticizes any separated and renewed “dominant religion”. The tragedy of every secular religion is that, having become a mass structure, they are controlled by the order of the church and other religious institutions. Later, of course, they violate the initially proclaimed principles of freedom, independence and happiness.

No rituals, ceremonies, or theoretical content constitute the inner essence of a “humanistic religion”. Its center, origin, and eternal content, according to Fromm, is “religious experience”, that is, the state of being directly felt by a person. The process characteristic of our time is religions that are directly directed at subjective feelings. In essence, Erich Fromm’s “humanistic religion” resembles the worldview of modern

believers. In its religious structure, creeds and rituals do not play a central role, but rather the subjective feelings of a person, the feeling of moral happiness, are important.

Doesn't "religious experience" lose its religious content in this approach? – the question arises naturally. If the above-mentioned features are not called religious by virtue of their absence of any transcendent source, they cannot be considered a privilege of believers. After all, Fromm does not even claim this. "The majority of those who undoubtedly believe in God," writes Fromm, "in their human relationships or in communication with non-believers, believe in all sorts of old-fashioned and heretical things. Some militant "atheists" devote their entire being to improving human life, glorify cooperation, brotherhood, and love, and practically demonstrate their belief in a deeply religious attitude" [4].

Therefore, Fromm comes to a contradictory conclusion: religious experience, which embodies the principles of love and justice, freedom and happiness, is more characteristic of firmly believing believers, that is, atheists. This result became possible after the transformation of religion into humanistic ethics, or rather, he raised ethics to the level of "humanistic religion". In support of his point of view, Fromm writes: "I believe that the difference between morality and religiosity is partial, not absolute" [4]. When he tries to clarify this, that is, to prevent the complete merging of religious experience with ethics, he limits himself to general considerations. "Religious experience is understood only by those who have experienced it, they themselves do not need any definition or clarification [4]," says E. Fromm.

## Conclusions

Erich Fromm's doctrine of religion, rooted in his humanistic and dialectical psychoanalysis, offers a profound exploration of the human condition, emphasizing the existential and social dimensions of spirituality. Fromm redefines religion as a response to the fundamental contradictions of human existence, transcending traditional notions of deity worship to encompass broader philosophical, ethical, and socio-political systems. He critiques "dominant religion" for its alienating tendencies, advocating instead for a "humanistic religion" centered on subjective experience, love, justice, and freedom. Fromm's unique perspective blurs the lines between religiosity and ethics, suggesting that true religious experience is often embodied by those who prioritize humanistic values, including atheists. His work challenges conventional religious paradigms, offering a transformative vision of spirituality that aligns with the needs of modern society.

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# THE INTERPRETATION OF “UNARMED SOLDIERS” OR “LABOR ARMY” IN RUSSIAN HISTORIOGRAPHY

**Kurbanov Xurshid**
*Associate Professor, Candidate of Historical Sciences, Navoi State University*
xurshid.kurbanov.82@mail.ru

**Annotatsiya.** Ushbu maqolada Ikkinchi jahor urushi yillarida Ural sanoat korxonalarida mehnat qilgan “Qurolsiz askarlar”ning taqdiri va qismati bayon qilinadi.

***Kalit so‘zlar:*** *Ikkinchi jahon urushi, Ural, mehnat, “Qurolsiz askarlar,” hayot, taqdir, evakuatsiya, lagerlar, tadqiqot*

**Аннотация.** В статье рассказывается о творчестве, образе жизни и судбе узбекских “безоружных солдат,” которые много работали на Урале в годы Великой Отечественной войны и внесли достойный вклад в Победу.

***Ключевые слава:*** *Вторая мировая война, Урал, труд, “солдаты без оружия,” жизн, судба, эвакуация, лагеря, исследования*

**Abstract.** The article discusses the creativity, lifestyle, and fate of Uzbek “unarmed soldiers” who worked extensively in the Urals during the Great Patriotic War (World War II) and made a significant contribution to the Victory.

***Keywords:*** *World War II, the Urals, labor, “unarmed soldiers,” life, fate, evacuation, camps, research.*

## Introduction

Based on the secret decree № 2414 of the State Defense Committee of the USSR on October 14, 1942, 350,000 labor army personnel from the Central Asian republics were mobilized to work at industrial and construction sites in the Urals region of Russia. Specifically, the first contingent of 150,000 workers from Uzbekistan arrived in the Chelyabinsk and Chkalov regions by the end of 1942 and began their activities. However, issues such as the accommodation of workers, living conditions, housing situations, food supply, medical services, and sanitation remained problematic.

Additionally, the inability of Central Asians to adapt to the climatic conditions and language barriers also contributed to the untimely deaths of many workers. In this regard, the study of this topic holds significant importance in the history and historiography of Uzbekistan.

During 1941-1945, the concept of “labor army personnel” emerged in everyday life, referring to those who carried out these tasks, and this term became synonymous with the idea of “unarmed soldiers.”

## Literature Review

While certain aspects of this issue have been partially noted in Uzbek historiography, it has been more extensively studied in Russian historiography.

For example, the 1985 encyclopedia “The Great Patriotic War.” 1941-1945 mentions these terms alongside concepts such as “labor legislation,” “labor duty,” and “labor reserves” [1].

Arkady Adolfovich German, a professor and founder of the International Association for the Study of the History and Culture of Russian Germans, explains that labor army personnel were individuals mobilized by military commissariats and recruited for labor, concentrated under the supervision of NKVD camps and subjected to strict barracks-like conditions. He emphasizes that these “labor army personnel” aimed to elevate their social status from being “prisoners” to “labor army members” [3].

***The History of “Labor Army Personnel” in Historiography.*** In the 1980s, the history of "labor army personnel" began to be explored in historiography, with a series of articles published by authors such as Gordon L., Klopov E., and Cherednik E.I., focusing on the deportation of Soviet Germans and other ethnic groups.

In 1990-1991, Zemskov V.N., in his scholarly works on the widespread practices of exile and deportation in the USSR and the activities of the GULAG, explained that Soviet citizens (Germans, Finns, Romanians, Hungarians, Italians) mobilized for construction projects under the NKVD and other commissariats formed “worker battalions,” which essentially constituted the “labor army personnel.” These “worker battalions” were integrated into the GULAG system [4].

At an international conference held in Anapa in 1996, Kurochkin A.N. attempted to clarify the concept of “labor army personnel.” According to his view: “The term labor army personnel can be applied to those forcibly recruited into worker battalions, columns, and detachments, who worked under centralized militarized conditions, such

as barracks, and within internally guarded punishment colonies." In general, he emphasized that the "labor army" used during 1941–1945 was a militarized form of labor for a specific category of Soviet citizens [5].

The concept of "labor army personnel" has also been explored in the research of Bugay N.F., Bikmatov R., Zabolotskaya K., Gerber O.A., Birbasova N.V., Antufyeva A.A., Malamud Y., Paletskikh N.P., Schaefer E.A., and N.V. Klimov. They have examined the term from various perspectives, often referring to them as "mobilized Germans." Additionally, they have highlighted the strict and militarized application of forced labor practices, which contributed to the expansion of the GULAG system under the NKVD and the establishment of new camps [6].

In the conclusion of V.M. Kirillov's fundamental research published in 1996, the following points are emphasized:

"...The population of Uzbekistan, Turkmenistan, Kazakhstan, Chuvashia, and Mordovia was subjected to mass forced labor, exploiting the unpaid labor of prisoners. The labor of Soviet Germans and Poles from Western Ukraine, Belarus, and the Baltic regions was also utilized. Under these conditions, the Tagil construction project was established within the NKVD system, and the Tagillag camp was formed. Worker battalions and columns composed of mobilized laborers were organized. According to the author, the forced labor system expanded further due to the inclusion of prisoners of war, individuals who had lost their military or party documents, and their relatives, who were also integrated into the labor army [7]."

One of the Ural historians, E. Kornilov, in his scholarly articles, provided a deep analysis of the activities of "labor army personnel" based on extensive archival documents. He compared previously used sources and introduced them into scientific discourse, analyzing the documents from an ideological and fair perspective [8].

In the second half of the 1990s, Morozov N.A. conducted a comprehensive analysis of the situation and activities of the German population during 1941-1945. He divided their mobilization into the "labor army" into four stages and highlighted that not only ethnic Germans but also representatives of other nationalities, such as Koreans, Russians, Ukrainians, Belarusians, Kalmyks, and others, were recruited to work in industrial enterprises.

Knyshevsky P.N., who extensively studied the activities of the State Defense Committee in mobilizing labor resources, used the term "labor front" to describe the category of mobilized workers. He emphasized that the "labor front" expanded with the inclusion of deported peoples, individuals unfit for military service due to health reasons, those discharged from the army, and people from the GULAG system. Researcher Paletskikh N.P. supported this logical reasoning and proposed categorizing the "labor army" into groups such as "construction battalions," "worker columns," and "Soviet-German camps."

Historical research on the phenomenon of the "labor army" during World War II has shown that these processes should now be studied not only in articles or theses but as a genuine "object" of research. The concept of "labor army personnel" requires both narrow and broad examination to achieve its objectives.

Gorelik E.M., Emelyanova A.P., and Chikalaeva E.P. have focused their research on the labor processes of “labor army personnel” in the production enterprises and factories of the Ural region [9].

Goncharov G.A. dedicated his scientific works entirely to the activities of the labor army personnel in the Urals. His numerous scholarly articles on this topic later evolved into a doctoral dissertation-level study [10].

## Research Methodology

This article adopts a historical perspective. It examines the status of “labor army personnel,” the scientific developments in Russian historiography on this topic, and the role of labor army personnel in the socio-economic and military-industrial activities of the Urals. It also provides a scientific analysis of their classification and social status.

In historiography, this period, like the 1920s-1930s of the 20th century, introduced many new concepts and terms that require specific classification. In the first half of the 20th century, the term “labor army” was used, and the process of working in this system carried a certain connotation of “slavery.” During this period, almost all rights of individuals against forced labor were suppressed.

## Analysis and Results

The interpretation of these concepts depends on the ideas, ideologies, and approaches used to translate and analyze them. Historical-philosophical observations require a foundation of historical accuracy, objectivity, and deep reflection.

Workers mobilized from Central Asia labored under extremely harsh and challenging conditions in industrial and construction enterprises in the Urals, Southern Urals, Bashkiria, Chelyabinsk, and other regions. They demonstrated immense heroism and courage in producing weapons, ammunition, clothing, and other supplies to meet the demands of the front and achieve victory over the enemy.

## Conclusions and Recommendations

Based on the analysis of the implementation of the 1942 decree №2414 by the former State Defense Committee, the following conclusions can be drawn:

The German leadership, when initiating war against the Soviet Union, hoped to exploit national conflicts and fragmentation within the multi-ethnic USSR. However, these calculations proved incorrect.

The victory over Nazi Germany during the war years was achieved through the collective heroism of all Soviet peoples, the mass bravery of Red Army soldiers at the front, and the united efforts of workers from all nationalities behind the frontlines, all aimed at defeating the enemy.

In particular, it is essential to highlight the contribution of 150,000 Uzbek “unarmed soldiers” who played a significant role in providing raw materials, weapons, and equipment to the front between 1942 and 1944.

During World War II, policies were implemented to address labor shortages, organize labor, and solve related problems. Studying the number, composition, location, material-social conditions, and labor relations of “unarmed soldiers” is a

separate issue. In this regard, scientific expeditions and the use of primary archival sources, narrative materials, and oral history are crucial.

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# THE SOCIO-POLITICAL ENVIRONMENT IN TURKESTAN IN THE 19TH - 20TH CENTURIES AND THE CAUSES OF THE EMERGENCE OF THE JADID MOVEMENT

**Negmatova Shakhzoda Shukhratovna**
*Professor, "National Idea and Philosophy" Department of Uzbekistan-Finland Pedagogical Institute*
shnegmatova83@gmail.com

**Annotatsiya.** Ushbu maqolada XX asr boshlarida Turkistonda ta'lim tizimining rivojlanishi va milliy uyg'onish hamda ijtimoiy islohotlardagi jadidchilik harakatining o'rni tahlil qilinadi. Jadidlar ta'limni modernizatsiya qilish, ijtimoiy tengsizlikni bartaraf etish va o'z-o'zini boshqarishni targ'ib qilish orqali jamiyatni yuksaltirishga intilgan.

***Kalit so'zlar:*** *jadidchilik, milliy ozodlik harakati, ta'lim islohoti, ma'rifatchilik, dunyoviy ta'lim, Turkiston, rus-tuzem maktablari.*

**Аннотация.** В данной статье рассматривается развитие системы образования в Туркестане в начале XX века, а также рол джадидского движения в националном пробуждении и социалных реформах. Анализируется, как джадиды стремилис модернизироват образование, устранит социалное неравенство и способствоват самоуправлению через просвещение и интеллектуалное развитие.

***Ключевые слова:*** *джадидизм, национально-освободителное движение, реформа образования, просвещение, светское образование, Туркестан, русско-туземные школы.*

**Abstract.** This article examines the development of the educational system in Turkestan at the beginning of the 20th century and the role of the Jadid movement in national awakening and social reform. It analyzes how the Jadids sought to modernize education, eliminate social inequalities, and promote self-governance through enlightenment and intellectual advancement.

***Keywords:*** *jadidism, national liberation movement, educational reform, enlightenment, secular education, Turkestan, Russian-native schools.*

## Introduction

When we hear phrases such as "national liberation movement" and "struggle for independence," we first envision our ancestors who sacrificed their lives and shed blood on the battlefield for their homeland. However, the struggle for independence has not always taken place on the battlefield. The Jadids, recognizing that achieving independence through war and revolts was impossible, considered raising public consciousness and providing quality education to the youth as their primary weapon. As President Shavkat Mirziyoyev emphasized:

*"At the beginning of the 20th century, our patriotic Jadid forefathers, relying on the ideas of enlightenment, sought to lead our people from backwardness to the path of progress, equipping them with secular knowledge and advanced professions. They aimed to establish freedom, justice, equality, enlightenment, and national identity, as well as to develop our ancient culture and language as the meaning and purpose of their lives" [1].*

Indeed, during this period, the Jadid movement brought significant transformations to Central Asia, particularly Uzbekistan. This intellectual and cultural movement aimed to reform society and modernize education based on the principles of enlightenment. The idea of using knowledge and education to elevate society was directed at encouraging the youth to acquire secular knowledge and advanced professions, eliminating social inequalities in Central Asia, and promoting self-governance.

## Literature Review

Despite the growing number of scholarly studies on the Jadid movement, differing perspectives continue to emerge due to the destruction of historical records and archival documents under Soviet rule. Particularly in the works of international scholars, the Jadid movement, as part of the broader struggle for liberation among Muslim peoples under Russian colonial rule, is described with varying interpretations. Historian Edward Allworth characterizes the Jadid movement as a national liberation movement in Turkestan, stating that it *"opened a new chapter in the history of the peoples subjected to Russian imperial rule and developed as an ideological-political system aimed at the awakening and growth of local identities" [2].*

Political scientist Adeeb Khalid describes the Jadids as *"individuals involved in the movement to reform Muslim societies through new social structures and modern means" [3].* Researchers such as Jeff Eden, Paolo Sartori, and Devin DeWeese define Jadidism as *"a movement composed of small groups, organizationally weak" [4].* However, historical evidence confirms that the Jadids operated as an organized movement with a distinct structure.

Alexander Bennigsen and Enders Wimbush argue that *"Jadidism displayed more of a national character than a religious one" [5].* Edward J. Lazzerini supports this view, concluding that *"epistemologically, the movement did not adhere strictly to Islamic norms" [6].* Meanwhile, Uzbek scholar J. Nurmatov and his colleagues define Jadidism as *"a national-cultural movement with a religious character" [7].* This interpretation is based on the fact that Islam was deeply embedded in the social, cultural, and political life of Central Asian Muslims at the time and was the primary force influencing their national identity.

## Research Methodology

This study employs a historical and comparative analysis approach to examine the socio-political environment of Turkestan in the 19th -20th centuries and the emergence of the Jadid movement. Primary sources, including archival records, government documents, and contemporary writings of the Jadids, have been reviewed to reconstruct

the intellectual and ideological foundations of the movement. Additionally, secondary sources such as academic monographs, journal articles, and historical analyses by scholars like Edward Allworth, Adeeb Khalid, and Alexander Bennigsen are utilized to provide a broader understanding of Jadidism's role in national identity formation and social reform.

The research follows a **qualitative methodology**, integrating textual analysis of historical documents with a thematic review of literature on educational reform, nationalism, and colonial resistance. A comparative approach is applied to assess the impact of Jadidism in Turkestan relative to similar movements in other parts of the Muslim world, including the Middle East, Crimea, and the Caucasus.

Furthermore, discourse analysis is employed to evaluate the narratives surrounding the Jadid movement, particularly in Soviet and post-Soviet historiography. This helps to identify ideological biases in the representation of the movement and its key figures. By synthesizing multiple perspectives, this study aims to offer a nuanced understanding of the factors that influenced the rise, development, and eventual suppression of the Jadid movement.

Although the Jadids proposed integrating secular sciences into their curriculum, they did not intend to criticize Islam. Instead, they sought to connect science with Islam and convey this interrelation to the public. The various definitions and interpretations of Jadidism suggest that the Russian Empire's military, technological, and economic superiority over Central Asian nations prompted the Jadids to focus on modernizing their people in these areas, particularly through educational reforms. As a result, Jadidism branched out into multiple sectors, encompassing political, military, economic, religious, educational, and national-cultural reforms, forming a well-structured movement.

The nearly half-century-long active existence of the Jadid movement can be divided into several stages. According to American historian Edward Allworth, Jadidism in Turkestan developed in two phases:

1. **In the first phase,** the Jadids struggled for a unified Turkestan.
2. **In the second phase,** they advocated for each ethnic group within Turkestan to have the right to determine its own fate [2].

Uzbek historian Sh. Salomov, however, categorizes the movement into three periods:

1. **Before World War I,** the Jadids primarily functioned as educators and mentors spreading enlightenment.
2. **After World War I,** they began advocating for a parliamentary monarchy.
3. **Following the February Revolution of 1917,** many Turkestan Jadids started demanding large-scale political reforms [8].

Kulshanova A.A. directly links the stages of the Jadid movement to its ideological principles [9]. In the initial phase, the Jadids focused solely on educational reforms. The second phase, following the Russian Revolution of 1905, marked a shift toward democratic and political ideas. In the final phase, despite persecution by the Russian

authorities, which led to the execution of key figures, the movement did not disappear entirely; rather, it continued to operate covertly in various forms.

The social and political environment that gave rise to Jadidism and its development was shaped by both internal and external factors. In the late 19th and early 20th centuries, Jadidism emerged as a response to the socio-political conditions in Russian-controlled colonies, including Turkestan. Its primary objectives were to eliminate illiteracy and ignorance, create opportunities for education, and spread enlightenment and patriotism among the local population.

**Analysis and Results**

Jadidism became the principal ideological movement opposing subjugation and servitude among Muslim communities in Crimea, the Volga region, the Caucasus, and Turkestan during the late 19th and early 20th centuries. Its supporters sought modernization, new forms of education, and national progress [8]. They believed that achieving these goals was only possible through education, leading them to establish new-method (Jadid) schools, send young students abroad for higher education, and encourage foreign language learning.

The ideological views of Turkestan's Jadids were reflected in several key aspects:

1. **Criticism of backwardness** – The Jadids strongly criticized the social, educational, economic, and military stagnation that had taken hold in Turkestan.
2. **Opposition to religious superstition** – They condemned blind adherence to baseless beliefs, advocating for the eradication of harmful social practices such as polygamy and child marriage.
3. **Advocacy for national statehood** – They promoted the idea of creating a national state as a means for the Uzbek people to achieve independence.
4. **Constitutional governance** – The Jadids were among the first to propose adopting a constitution as a foundation for an independent society.
5. **Recognition of native language** – They argued that granting official status to the local language was crucial for national identity and social progress.
6. **National currency and military** – The Jadids introduced the idea of a national currency and advocated for the establishment of Turkestan's armed forces.

The social-political environment that shaped the Jadid movement was also influenced by Russian policies toward education in Turkestan. By the early 20th century, the majority of the population received education in **madrasas**, while the Russian government began establishing its own schools. These schools were classified into three types:

1. **Specialized schools for training translators**
2. **Elite schools for children of Russian families and government officials**
3. **“Russian-native” schools aimed at integrating Muslims into Russian culture**

The colonial authorities only recognized individuals fluent in Russian and educated in Russian-native schools as literate. They maintained the view that before Russian colonization, the local population had been illiterate and had only begun receiving education after the arrival of Russian rule. However, historical records indicate that

traditional schools and madrasas provided education long before the establishment of Russian-native schools.

## Conclusions

In conclusion, the Jadid movement was not merely an educational reform initiative but a comprehensive national movement striving for independence, social progress, and modernization.

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# THE ROLE OF DOMESTIC POLICY ON THE DEVELOPMENT OF PAKISTAN AS A WHOLE (1947-1965)

**Sadikova Renata Shamilevna**
*Independent Researcher (PhD),*
*Mirzo Ulugbek National University of Uzbekistan*
rena.raxmanova95@gmail.com

**Annotatsiya.** Ushbu maqolada ichki siyosatning Pokistonning mustaqillikdan 1965 yilgacha rivojlanishiga ta’siri tahlil qilinadi. Tadqiqotda istiqloldan keyingi ijtimoiy-siyosiy, iqtisodiy va madaniy o‘zgarishlar va ularning milliy taraqqiyotga ta’siri o‘rganiladi. Tadqiqot tarixiy tahlil va davr adabiyotlarini ko‘rib chiqishga asoslangan bo‘lib, asosiy e’tibor ichki siyosatga oid qarorlar va ularning oqibatlariga qaratiladi.

***Kalit so‘zlar:*** *Pokiston, ichki siyosat, milliy taraqqiyot, mustaqillikdan keyingi davr, iqtisodiy islohotlar, ijtimoiy siyosat.*

**Аннотация.** В этой статье анализируется влияние внутренней политики на развитие Пакистана с момента обретения независимости до 1965 года. В исследовании рассматриваются социально-политические, экономические и культурные изменения после обретения независимости и их влияние на национальное развитие. Исследование основано на историческом анализе и обзоре литературы того периода, с упором на ключевые решения во внутренней политике и их последствия.

***Ключевые слова:*** *Пакистан, внутренняя политика, национальное развитие, период после обретения независимости, экономические реформы, социальная политика.*

**Abstract.** This article analyzes the influence of domestic policies on Pakistan's development from independence until 1965. The research examines the socio-political, economic, and cultural changes following independence and their impact on national development. The study is based on historical analysis and literature review of the period, focusing on key domestic policy decisions and their consequences.

***Keywords:*** *Pakistan, domestic policy, national development, post-independence period, economic reforms, social policy.*

## Introduction

The emergence of Pakistan as an independent state in 1947 marked a pivotal moment in South Asian history, initiating a complex period of nation-building and domestic policy development. The partition of British India resulted in unprecedented challenges for the newly formed nation, requiring immediate and decisive policy responses across multiple fronts. The period from 1947 to 1965 represents a critical phase in Pakistan’s

history, during which domestic policies played a fundamental role in shaping the country's developmental trajectory [1-3].

In the immediate aftermath of independence, Pakistan faced numerous challenges that demanded urgent attention. These included the massive influx of refugees from India, the need to establish functional governmental institutions, the imperative to develop a viable economic system, and the challenge of forging a unified national identity among diverse ethnic and linguistic groups. Under the leadership of Muhammad Ali Jinnah, the country's first Governor-General, Pakistan embarked on an ambitious journey of state-building while grappling with these multifaceted challenges [2].

The significance of studying this period (1947-1965) lies in understanding how early domestic policy decisions influenced Pakistan's subsequent development path. This era witnessed several crucial transitions: from civilian to military rule, from an agricultural to an industrializing economy, and from traditional to modern administrative structures. The domestic policies implemented during this period not only addressed immediate post-independence challenges but also laid the foundation for Pakistan's future political, economic, and social framework [4-9].

## Literature Review

The literature review reveals a rich body of scholarly work examining Pakistan's early development period from various angles. Ayesha Jalal's seminal work "The Struggle for Pakistan" [3] provides a comprehensive analysis of the challenges faced during the nation-building process. Her research particularly emphasizes the complex interplay between political institutions and policy implementation in the early years of independence. Stephen Cohen's "The Idea of Pakistan" [2] offers valuable insights into the ideological underpinnings of Pakistan's domestic policies and their long-term implications for national development.

Uzbek scholars have also made significant contributions to understanding this period. Khudoyberganov's "Pakistan's Path to Independence and Development" [10] provides a unique Central Asian perspective on Pakistan's early development challenges, particularly focusing on the economic and social transformation during the 1950s. Similarly, Usmanov's "South Asian Politics: Pakistan's First Two Decades" [11] offers a valuable analysis of Pakistan's political evolution and its impact on regional dynamics.

The economic aspects of Pakistan's domestic policies have been extensively analyzed by Khan [4], who examines the implementation and outcomes of early economic planning initiatives. Talbot's work [7] provides crucial insights into the institutional development and administrative challenges faced during this period. The social and cultural dimensions of domestic policy are well-documented in Ahmed's research [1], which examines the complex process of national integration and identity formation.

Pakistani scholars like Sayeed [6] have contributed significantly to understanding the political system's evolution, while Waseem [8] provides a detailed analysis of state-

society relations during this period. These works collectively highlight the multifaceted nature of Pakistan's domestic policy challenges and their impact on national development.

## Research Methodology

This research employs a comprehensive historical-analytical approach to examine Pakistan's domestic policies between 1947 and 1965. The methodology primarily focuses on qualitative analysis of historical documents, academic literature, and official records from diverse sources, including Western, South Asian, and Central Asian perspectives. The research framework incorporates both chronological and thematic approaches to analyze the evolution and impact of domestic policies during this crucial period.

## Analysis and Results

The analysis of Pakistan's domestic policies between 1947 and 1965 reveals a complex tapestry of political transformation, economic development, and social change. This period was characterized by significant policy initiatives that shaped the nation's developmental trajectory across multiple dimensions.

The political landscape of Pakistan during this period underwent dramatic transformations that profoundly influenced the country's development path. The untimely death of Muhammad Ali Jinnah in 1948 created a significant leadership vacuum that the nascent state struggled to fill [McGrath, 2016]. The subsequent period witnessed a series of political crises, culminating in the military coup of 1958 led by Ayub Khan. This transition from civilian to military rule marked a fundamental shift in Pakistan's governance structure and policy-making approach.

The military regime under Ayub Khan introduced the Basic Democracies system, which, while ostensibly aimed at grassroots political participation, effectively centralized power and created a new political hierarchy. This period also saw the implementation of the 1962 Constitution, which institutionalized a presidential system and further consolidated executive authority. These political changes had far-reaching implications for policy formulation and implementation across all sectors of national development.

The economic policies during this period reflected a strategic shift from a predominantly agricultural economy toward industrial development. The implementation of the First Five-Year Plan (1955-1960) marked Pakistan's entry into systematic economic planning [4]. The government adopted a mixed economy approach, combining state-led industrialization with private-sector participation. This period saw the establishment of key industrial units, the development of infrastructure, and the creation of essential financial institutions.

The agricultural sector underwent significant changes through land reforms and the introduction of modern farming techniques. However, these reforms had mixed results, with some regions benefiting more than others, leading to regional economic disparities that would later become sources of political tension. The period also witnessed the

emergence of a new industrial class and the beginning of Pakistan's green revolution, though the benefits of these developments were not equally distributed across society.

The social policy landscape during this period was dominated by the challenges of refugee integration, educational development, and cultural harmonization. The government faced the enormous task of integrating millions of refugees from India while simultaneously building a cohesive national identity. The education sector saw significant expansion, though it struggled with issues of quality and access. Language policy became a particularly contentious issue, especially regarding the status of Urdu as the national language and its relationship with regional languages.

The period also witnessed significant efforts in social welfare programs, including public health initiatives and housing schemes. However, these programs often faced implementation challenges due to limited resources and administrative capacity. The government's attempts to forge a unified national culture while respecting regional diversity created tensions that would influence future policy decisions.

The development of administrative institutions during this period laid the groundwork for Pakistan's modern state apparatus. The civil service underwent significant reorganization, though it largely retained its colonial structure. Local government reforms under Ayub Khan's regime attempted to create a more efficient administrative system, but also served to strengthen central control over local affairs [8].

The judiciary saw important developments during this period, including the establishment of key legal precedents that would influence future governance. However, the relationship between various state institutions remained complex, often leading to jurisdictional conflicts and governance challenges.

Though this analysis focuses on domestic policy, it's important to note that international relations, particularly Cold War dynamics and relations with neighboring countries, significantly influenced domestic policy choices. The alignment with Western powers affected economic aid and development priorities, while regional tensions, especially with India, influenced resource allocation and development strategies.

These results demonstrate that the period from 1947 to 1965 was characterized by ambitious policy initiatives across multiple sectors, though their implementation and outcomes were often complicated by political instability, resource constraints, and administrative challenges. The policies of this era laid the foundation for many of Pakistan's modern institutions and development patterns, while also creating some of the structural challenges that would persist in later years.

## Conclusions

The examination of Pakistan's domestic policies from 1947 to 1965 reveals a complex interplay of achievements, challenges, and transformative changes that fundamentally shaped the nation's development trajectory. This crucial period in

Pakistan's history demonstrated both the potential and limitations of domestic policy in driving national development under challenging circumstances.

The early years of independence were marked by significant accomplishments in establishing basic state institutions and implementing initial economic reforms. However, these achievements were often overshadowed by political instability, culminating in the military takeover of 1958. The Ayub Khan era, while bringing certain economic gains and administrative reforms, also introduced long-term structural challenges in Pakistan's political system.

The domestic policies of this period had far-reaching implications that continue to influence contemporary Pakistan. The emphasis on rapid industrialization, though successful in creating an industrial base, led to regional economic disparities. Similarly, the centralization of political power and the focus on modernization without adequate attention to social equity created tensions that would manifest in later years.

Perhaps most significantly, this period highlighted the crucial relationship between political stability and sustainable development. The transition from civilian to military rule, while temporarily providing administrative efficiency, established precedents that would affect Pakistan's political evolution for decades to come. The experience of these formative years underscores the importance of balanced, inclusive domestic policies in ensuring long-term national development.

Looking back at this period provides valuable insights for understanding contemporary Pakistan and offers lessons for future policy-making. The successes and failures of domestic policies during these crucial years continue to resonate in Pakistan's ongoing journey of national development, serving as both a guide and a warning for future policy directions.

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# THE BIRTH OF THE HERO IN UZBEK FOLK TALES AND ITS CONNECTION TO NATIONAL TRADITIONS

**Ruzmetova Sohiba Aminbayevna**
*Senior Lecturer, Urgench Ranch of the Technology University*
srozmetova215@gmail.com

**Annotatsiya.** Ushbu maqola O‘zbek xalq ertaklarida qahramonlarning tug‘ilishiga oid alomatlarni o‘rganadi. Maqola, alomatlarning mo‘jizaviy, tabiat bilan bog‘liq, ilmiy va diniy aspektlarini tahlil qilib, ular qanday qilib madaniy hayotga ta’sir ko‘rsatishini ko‘rsatadi. Alomatlar xalq e’tiqodlari, qadriyatlar va milliy o‘zlikni aks ettiruvchi ahamiyatga ega ekanligi ta’kidlanadi.

***Kalit so‘zlar:*** *Qahramonlarning tug‘ilishi, ertaklar, O‘zbek xalq mifologiyasi, madaniy hayot, alomatlar, xalq qadriyatlari, mo‘jizaviy tug‘ilish, tabiat va alomatlar, xalq e’tiqodlari, madaniy o‘zlik.*

**Аннотация.** Статья исследует знамения, связанные с рождением героев в узбекских народных сказках. В работе анализируются чудесные, связанные с природой, научные и религиозные аспекты этих знамений, а также их влияние на культурную жизнь. Подчеркивается, что эти знамения отражают верования, ценности и национальную идентичность народа.

***Ключевые слова:*** *Рождение богатырей, сказки, узбекская народная мифология, культурная жизнь, приметы, народные ценности, чудесное рождение, природа и приметы, народные верования, культурная самобытность.*

**Abstract.** This article explores the omens related to the birth of heroes in Uzbek folk tales. It analyzes the miraculous, nature-related, scientific, and religious aspects of these omens and shows how they influence cultural life. The article emphasizes that these omens reflect the beliefs, values, and national identity of the people.

***Keywords****: Birth of heroes, fairy tales, Uzbek folk mythology, cultural life, signs, folk values, miraculous birth, nature and signs, folk beliefs, cultural identity*

## Introduction

Uzbek folk tales not only reflect the cultural heritage of the people but also embody their values, worldview, and historical experience. In these tales, the birth of heroes is expressed through certain signs, which provide insight into their future social, spiritual, and ethnic roles. These signs often indicate that the hero’s birth is not merely an ordinary event but a moment of great significance for the people. This article examines the signs associated with the birth of heroes in Uzbek folk tales and their impact on cultural life [1].

*Signs Associated with the Birth of Heroes:* This phenomenon is often linked to miraculous or natural events. Before birth, signs such as the shining of stars, rainfall, or earthquakes may be observed. These signs predict the hero's future and signify their great importance to the people. Additionally, the appearance of religious or scientific symbols sometimes highlights the hero's uniqueness.

*Miraculous Birth and Signs:* In Uzbek folk tales, the signs related to the birth of heroes are often expressed in a miraculous manner. Before birth, certain stars or natural phenomena (rain, earthquakes, the shining of stars) may occur. These signs primarily serve as a prophecy about the hero's future.

*Connection with Nature:* In many folk tales, the birth of a hero is linked to a significant aspect of nature. For example, heroes are often born in mountains or wild forests, symbolizing their strength, freedom, and independence.

*Scientific and Religious Signs:* Some tales incorporate divine or religious concepts in the birth process. For instance, the appearance of special marks or sacred symbols (such as unique imprints or a radiant glow) on the newborn's face signifies the hero's extraordinary nature.

*Birth and the Needs of the People:* Heroes are often born in response to the needs of the people. Their birth is frequently foretold as a means to fulfill the wishes of the people, restore justice, or fight against evil forces. These signs are directly connected to the hero's future social role [2].

## Literature Review

*Impact on Cultural Life:* The signs associated with the birth of heroes in Uzbek folk tales influence the formation of cultural life, social values, and popular beliefs. Heroes are often born in response to the needs of the people, which signifies the preservation of cultural heritage, the strengthening of national identity, and the emergence of new social advancements.

*Formation of Public Beliefs and Values:* The signs related to the birth of heroes in folk tales are closely connected to the values and beliefs of the people. The miraculous aspects of birth symbolize the hero's ability to fulfill dreams and aspirations. Additionally, the emergence of new heroes who respond to the social and cultural needs of the people is interpreted as a sign of justice, peace, and progress [3].

*Identity and Cultural Transformations:* The signs associated with the birth of heroes reflect cultural changes and national identity. These symbolic signs of birth play a crucial role in depicting individuals who unite the people, preserve historical memory, and sustain cultural traditions across generations.

*The Social Role of Heroes and Cultural Advancement:* The birth of heroes and its impact on cultural life often signify social transformations. Heroes do not serve only themselves but contribute to society as a whole, and this is reflected in the signs marking their birth. Through their future actions and unique interpretations, they help drive social progress and uplift the people [4].

## Research Methodology

The signs associated with the birth of heroes in folk tales and epics are significant elements that reflect the spiritual, social, and cultural development of society. These signs should not only be viewed within the context of fairy tales and legends but also as a formative force in shaping society. The birth of heroes and its associated signs unite the people, strengthen national values, lead to social changes, and preserve historical memory [5].

When discussing the signs and the birth of heroes, we must recognize their importance in preserving cultural heritage, religious beliefs, and moral values, as well as ensuring stability and progress within society. All these aspects play a crucial role in shaping the spiritual and cultural future of the people.

Thus, the signs related to the birth of heroes in Uzbek folk tales and folklore should not be seen merely as fictional elements but as factors that shape society and guide social and cultural life [6].

## Analysis and Results

*Signs of heroic birth in uzbek folk tales:* The signs related to the birth of heroes in Uzbek folk tales are important elements that reflect national traditions, cultural heritage, and popular beliefs. These signs predetermine the hero's future, their role in society, and their social responsibilities. The birth of heroes is often depicted as miraculous or connected to natural phenomena, which signifies the hero's exceptional status in folk imagination.

Such tale motifs play a crucial role in strengthening spiritual values, preserving historical memory, and shaping national identity. The signs of a hero's birth reflect the moral norms, religious beliefs, and significant social changes in society. They contribute to national self-awareness, strengthen social solidarity, and serve as a means of educating future generations.

Moreover, these signs help reinforce concepts such as social justice, peace, and patriotism in tales and epics. The birth of heroes and their role in society create new expressions in national culture and art, ensuring the continuous transmission of cultural heritage through oral folk creativity.

***Key features of signs related to heroic birth***

Connection to miraculous and natural phenomena: In Uzbek folk tales, heroes are often born in a miraculous manner. For example, parents who have long suffered from childlessness conceive a child on a sacred day or under extraordinary natural circumstances. This signifies that the hero is not an ordinary person but someone destined to fulfill an important mission in society.

Presence of natural and cosmic signs: Sometimes, the hero's birth is associated with celestial movements, changes in the sun or moon, rain, or lightning. Such signs indicate that the hero is divinely chosen and guided by fate.

Animal-related birth omens: Many tales describe the birth of heroes with the help of animals or mythical creatures. Birds, fish, or magical animals often play a role in the hero's birth, emphasizing their unique mission.

Special signs related to the hero's parents: In many tales, the hero's parents are not ordinary people but kings, sages, or sacred figures. This provides a foundation for the hero's future leadership qualities.

***Cultural impact of heroic birth signs***

Strengthening national values: Through tales about the birth of heroes, the people pass on their core values from generation to generation. These include compassion, justice, honesty, patriotism, and self-sacrifice. The origins and qualities of heroes shape the nation's ideal conception of an exemplary individual.

Enhancing social unity: The birth of heroes and their heroic deeds promote social cohesion and cooperation. Even if the hero emerges from the common people, their fate serves the interests of the entire society. Through these tales, people strengthen their sense of unity and recognize their shared historical roots.

Preserving historical memory: Tales and legends about heroic births play a vital role in preserving national history and traditions. They help retain the people's past, achievements, and significant social transformations, passing them on to future generations.

Influence on art and literature: The motifs of heroic birth appear not only in oral folklore but also in written literature, theater, painting, and other art forms. The images of tale heroes become an essential part of national culture, serving as sources of inspiration in artistic and creative fields.

Shaping leadership and governance concepts: The signs of a hero's birth, their connection to fate, and their special role in society create a model for future leaders. Through heroes, society fosters individuals with leadership qualities.

Strengthening hope and faith in the future: The birth of heroes and their efforts to protect or develop their society reinforce people's hope and confidence in the future. These stories help people believe in a brighter tomorrow and encourage perseverance during difficult times.

The signs related to the birth of heroes in Uzbek folk tales are not only an integral part of the tale's plot but also a unifying and spiritually formative factor for the entire society. Through these motifs, the people's values, beliefs, and historical memory are preserved. Although the birth of heroes is portrayed as miraculous, they play a direct role in people's lives, strengthening social stability and enriching national culture. Therefore, studying and analyzing these tale motifs is important not only for folklore but also for the overall development of society.

## Conclusions

Based on the analysis of the signs related to the birth of heroes and their influence on cultural life, the following conclusions can be drawn:

1. Strengthening national values and beliefs: The birth of heroes reinforces the social and moral values of the people. The miraculous signs associated with their birth symbolize qualities such as justice, honesty, and sincerity. This process helps pass down past values and historical heritage to future generations.

2. Understanding national identity and unity: The signs of heroes' birth serve as unifying elements for the people. Heroes are not just individuals but are presented as significant figures for the entire society. As a result, national identity is strengthened, and collective hope and trust in the future grow.
3. Preservation of cultural traditions and historical memory: The signs related to birth emphasize the importance of national traditions and historical memory. The birth of heroes holds symbolic meaning in preserving these traditions and passing them on to future generations. Through fairy tales and epics, the process of safeguarding and studying national history continues.
4. Social change and renewal: Heroes often bring about significant transformations in social structures. The signs of their birth usually indicate the restoration of new values, equality, justice, and peace. These changes propel society toward a new stage of development.
5. Influence of religious and spiritual values: The signs of birth are often based on religious or spiritual motifs, linking heroes to higher moral and spiritual principles. This strengthens religious beliefs and values within society, fostering deeper moral awareness.
6. Collective memory and social cohesion: The signs of heroes' birth contribute to collective memory. They unite the people and play a crucial role in preserving historical events and identity. These signs symbolize national solidarity, readiness for social change, and aspirations for progress.
7. Formation of leadership and governance qualities in society: The birth of heroes and their associated signs contribute to the development of leadership and governance qualities in society. They inspire future leaders and prepare individuals for managing social transformations.
8. Emergence of new expressions in culture and art: The birth of heroes and their signs influence the creation of new artistic and cultural expressions. Their stories, legends, and epics inspire the development of artistic works, enriching the cultural heritage of the people. This, in turn, ensures cultural advancement.
9. Hope and confidence in the future: The birth of heroes and the associated signs strengthen people's hope and confidence in the future. The desire for justice, prosperity, and peace grows within society, leading to greater social stability and harmony.

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*UDC: 911.3, 911.6, 911.7*

# TERRITORIAL CHARACTERISTICS OF THE DEVELOPMENT OF SERVICE NETWORKS IN UZBEKISTAN

**Akhunbabayev Mamur Mahmudovich**
*Teacher, Department of Ecology and geography, Gulistan State University*

**Altibayeva Muxayyo Begimqulovna**
*Teacher, Department of Ecology and geography, Gulistan State University*

**Elmuradova Dilfuza Tulkinboy Kizi**
*Master Student, Department of Ecology and geography, Gulistan State University*

**Akhunboboeva Shoira Mamur Kizi**
*Master Student, Department of Ecology and geography, Gulistan State University*

**Annotatsiya.** Ushbu maqola respublikamizning xizmat ko‘rsatish tarmoqlarining hududiy xususiyatlarga bag‘ishlangan bo‘lib, bugungi kunda xo‘jalikning uchinchi yirik tarmog‘i hisoblangan xizmat ko‘rsatish tarmoqlari va viloyatda rivojlanishiga ta’sir etuvchi va ilmiy-amaliy yo‘nalishlari yoritilgan. Shuningdek, yangi turdagi xizmat turlarini tashkil etishga doir tavsiyalar berilgan. Mazkur holat mintaqa markazida joylashgan O‘zbekiston respublikasining ma’muriy hududiy birliklari misolida ilmiy-amaliy asosda ko‘rilgan.

***Kalit so‘zlar:*** *Xizmat turlari, hududiy tafovut, nomoddiy soha, yalpi hududiy mahsulot, oqilona foydalanish, muhofaza qilish, postindustrial.*

**Аннотация.** Данная статья посвящена территориальным особенностям обслуживания нашей республики и развивает научно-практические направления, влияющие на развитие обслуживания отраслей, составляющие сегодня третьи масштабы отраслям экономики в регионах. Также даны рекомендации по организации новых видов услуг. Настоящее положение было рассмотрено на научно-практической основе на основе принципа административно-территориальных единиц Республики Узбекистан, действующих в центре области.

***Ключевые слова:*** *Виды услуг, территориальная дифференциация, нематериальная сфера, валовой региональный продукт, рациональное использование, сохранение, постиндустриальный.*

**Abstract.** This article is devoted to the territorial characteristics of the service sectors of our republic, and today the third largest branch of the farm is the specialized service sectors and the areas of influence and scientific and practical development in the region are covered. Recommendations for the organization of new types of services are also given. This situation was seen on a scientific and practical basis in the example of the administrative-territorial units of the Republic of Uzbekistan, which are located in the center of the region.

***Keywords:*** *Types of services, territorial discrepancy, intangible sphere, gross territorial product, reasonable use, protection, postindustrial.*

## Introduction

If we look at the state of territorial development of the service sector of the republic, we can see that there are differences in the scope of services produced by its administrative units. Geographical differences in this regard are primarily due to the level of socio-economic development and demographic potential of the regions. While development is the impetus for the development of many intangible industries, the demand of the population, who are their main consumer, increases the types of services offered as well as the number of producers [4].

The main principle of the science of geography is its territoriality. After all, the science of geography cannot be imagined without territorial relations, without space. It is also an effective tool to analyze the division of territories into several groups according to the level of development of the service infrastructure system. This is primarily important in the provision of social services to the population, the placement of transport and several other service facilities, and the determination of the social progress of the region and the population [8].

Comparison of geographical aspects of regions is always territorial and divided into two types: comparisons that are similar and those that are non-similar. In many cases, the first type is more traditional, where objects are compared for scope, essence, and function. The second type of comparison implies opposition of the characteristics of the comparable objects whether they are large or small, their functions, essence, and other features [2]. In assessing the lifestyle of the population, first of all, the level of supplies of housing engineering communication facilities, electricity, clean drinking water, natural gas, and sewage networks are considered important.

Supplies of clean drinking water to the population in the regions of the republic is an urgent problem. The average clean drinking water supply rate of Uzbekistan is 75.3%. According to the statistics of the republic, the regions with a high level of access to clean drinking water are Fergana (98.1 percent), Andijan (93.9 percent), while the next to such are Tashkent region with 80.2 percent, Syrdarya (79.7 percent), Kashqadarya (78.7 percent), Surkhandarya — 74.1, Navoi 72.9, Namangan 72.5, and

Jizzakh region 71.2 percent. Relatively low rates are observed in the Samarkand region (57,3) and the Republic of Karakalpakstan in 54,4 percent. In these regions, the problem of clean drinking water is burning in almost half of the population. The origins of these problems are in many ways ecological, geographical, and demographic.

The lowest rates are in the regions of Kharezm and Bukhara, where only 41.6% and 39.6% of the population are supplied with clean drinking water.

The level of supply of natural gas is also important in improving the standard of living of the population. On average, 55.5 percent of the population in our country is supplied with natural gas, and there are territorial differences between the regions. Relatively high rates are 60-68 percent in the Bukhara, Jizzakh, Khorezm, Syrdarya, Navoi regions of the country and the Republic of Karakalpakstan. The lowest rates in the country are noted in Kashqadarya, Surkhandarya, Andijan, Samarkand, Namangan, Fergana regions with a natural gas supply rate of 23 percent to 43 percent, which means that on average a third of the population of these regions is supplied with natural gas. In general, almost half of the population of our republic has a problem with natural gas supplies.

Today, the process of transition to a socially oriented market economy is carried out taking into account many factors and features in the socio-economic development of our country, including the geopolitical and geostrategic role of our republic, mineral-raw material resources and natural climatic conditions, the demographic situation, customs and traditions, lifestyle, mentality and strong social policies inherent in the population.

The goal of any economic development is to promote the social interests of the population. Social sector networks are closely linked to the economy, and are intended to develop them in a coordinated manner, giving greater priority to social issues. We also witness territorial differences in the level of provision of sewage networks in our country. The average in the republic is 35.7 percent, and this service sector is among the most lagging behind industries. In particular, while it is 20.7% in Khorezm region, it is 17.9% in the Kashqadarya region and 10.7% in the Republic of Karakalpakstan.

Within the social industry sectors, trade and paid services are of fundamental importance. In turn, private entrepreneurship and small businesses are of high importance in these areas, and their numbers are increasing every year. In January-October 2022 the retail trade was 243,707.7 billion, which shows an increase of 11.7% compared to January-October 2021.

According to the data, the volume of market services provided in January 2022 rose by 4,631.4 billion sums, totaling 23,689.8 billion sums. The relative growth rate in January 2021 (104.6%) was 116.9%. The growth rate compared to January 2021 was 114.6%. The volume of market services provided per capita in January 2022 in our country was 678,5 thousand sums. By region, the highest rate corresponds to the city of Tashkent - 3257.0 thousand sums

Higher rates in the regional cross-section are 614.0 thousand sums to Tashkent region, 612.3 thousand sums to Navoi region, and 539.9 thousand sums to Bukhara

region, while the lowest rate of 312.9 thousand sums is registered for Kashqadarya region.

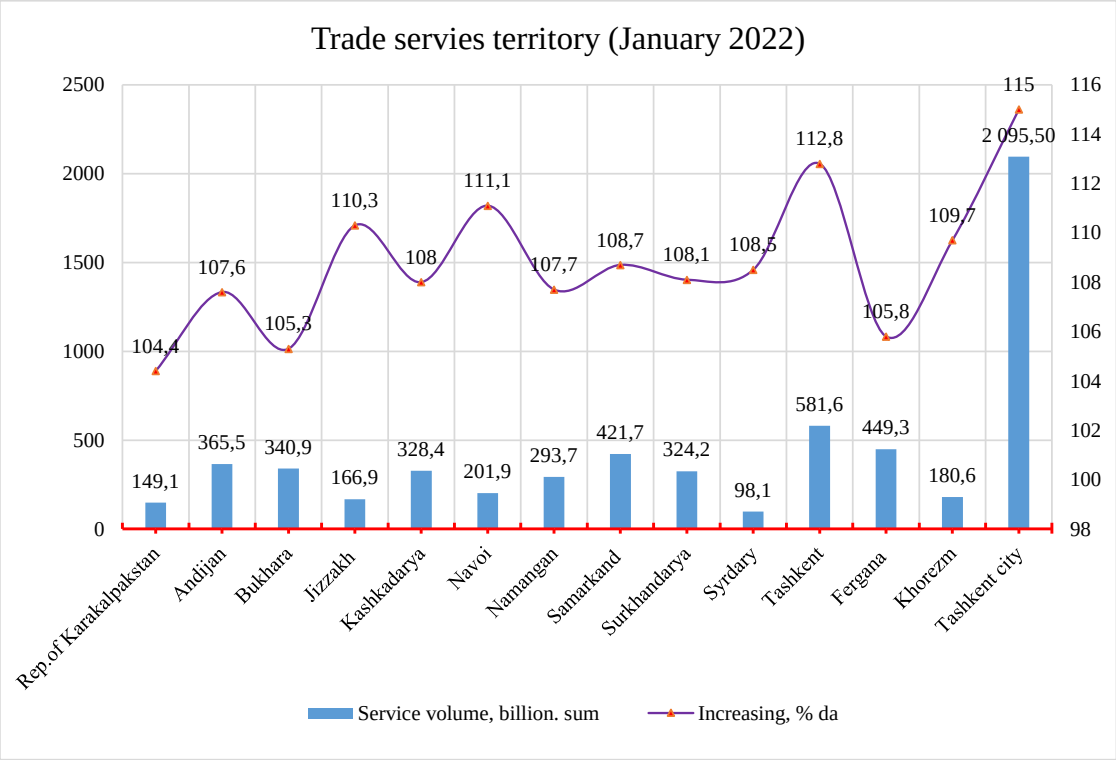


**Figure 1.** Trade services in the cross-section of territories in the Republic of Uzbekistan.

Among the market services offered in the cross-section of economic activities, the largest rate belongs to trade services. The share of these services in January 2022 was 25,3 %. As well as subsequent higher rates were recorded for financial services (24,2 %), transportation (21,4 %), communication and informatization services (6,4 %), as well as on services in the educational field (3,9 %). The volume of services related to computer repair slightly increased by 1.6%. The education system is one of the most important systems in the level of economic-social development. In a society where intellectual factors are considered strong, this field is of great importance in the current conditions.

The educational system of our republic is developed within the framework of the “Law on Education” adopted in the country in 1997 and implemented in stages, and the Law on Education in the new revision of September 23, 2020. Education is considered to be the main social field and includes the continuous system of preschool education, secondary schools, secondary special education, and higher education institutions. In 2022 the total number of secondary educational institutions in our country amounted to 10289, and the pupils studying in them amounted to 6304.6 thousand. Each general education institution has an average of 612 pupils. These figures vary according to aspects of the demographics of the regions such as a number of inhabitants, its growth and location, and age groups. Because, the largest number of pupils was recorded in the capital city of Tashkent, with an average of 1,320 pupils per school.

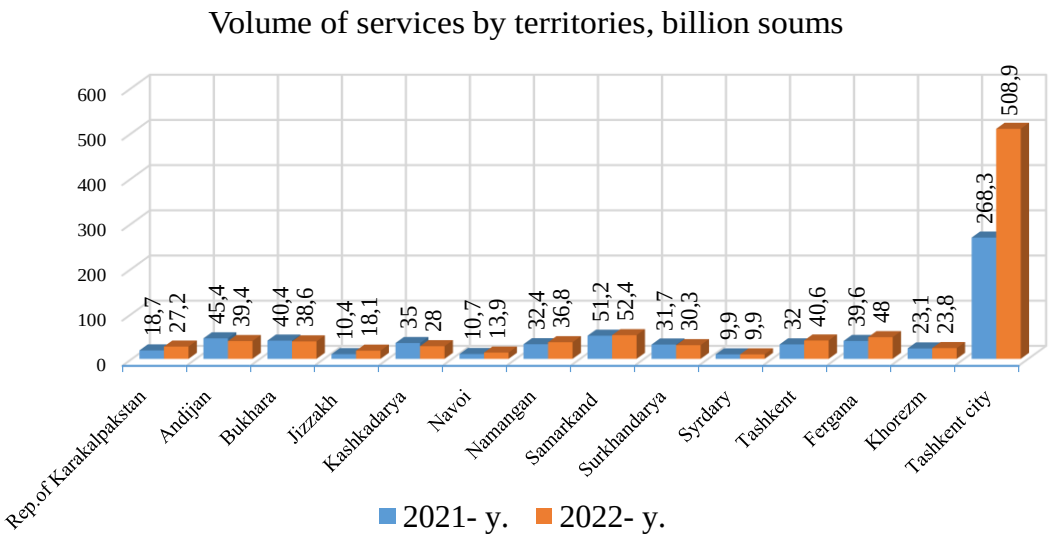


**Figure 2.** Educational services in the cross-section of territories in the Republic of Uzbekistan.

The high rates are observed in Ferghana Valley with its high demographic potential and large population settlements in the cross-section of the territories (580-590 thousand people). The average number of students in schools is 706 pupils. At the moment, in the Khorezm region, this parameter shows 636, and 540-580 pupils in the Samarkand, Tashkent, Bukhara, and Kashkadarya regions, while relatively low indicators do not reach 500 people in the Republic of Karakalpakstan, Syrdarya, Navoi and Jizzakh regions. The lowest indicator is registered in the Jizzakh region (464 students).

There are more than 86 academic lyceums in our country, most of which are established at the universities and institutes of higher education, where the educational system is conducted in two stages: secondary special and higher education in a harmonious way. Tashkent hosts most of the lyceums - 28, there are 8 lyceums in the Samarkand region, 7 - in the Kashkadarya region, 6 in the Karakalpakstan region, Fergana and Andijan regions have 5 each, Bukhara, Khorezm and Surkhandarya regions - 4 each, and Syrdarya, Jizzakh, Namangan, Navoi and Tashkent regions have 3 lyceums each.

A total of 35,900 students study in academic lyceums in the country. Each academic Lyceum has an average enrolment of 415-420 students. In this regard, the lyceums of Namangan and Jizzakh regions stand out, each of which has 600 students. Also, in Samarkand, and Khorezm regions, these indicators are 500 people. Each of the lyceums of Tashkent city has 350 students, the minimum numbers are recorded in the Kashkadarya region.

The territorial distribution of vocational colleges in our country is more dependent on the level of socio-economic development of regions, specialization of economic networks. In most cases, medical and pedagogical colleges are mainly located in medium and large cities. Colleges of economics, specialized trade, tourism, statistics, machinery, oil, and gas are established in separate regions.

There are 184 colleges in Uzbekistan, with a maximum of 22 in the Fergana region by region and a minimum of 4 in the Navoi region. The number of students studying at

the colleges is 95,200, and we can see that 14,900 students' study in the Fergana region, 10,600 in Andijan, 9800 in the Republic of Karakalpakstan, 8400 in Namangan, and 8000 students study in Tashkent city 8,000. Navoi region is also behind in this matter (1,700).

Currently, a total of 215 technical schools are operating in our country, while 105 students study in each of these. In terms of the number of available technical schools, Samarkand region has 23, Fergana 21, Andijan 20, Namangan 19, Tashkent and Surkhandarya regions - 17 each, 15 in the Republic of Karakalpakstan, 14 in each of Jizzakh, Bukhara regions, there are 13 technical schools in each of Khorezm and Kashkadarya regions, Navoi region and Tashkent city - 11 in each, and 7 in Syrdarya region. On average, there are 488 students in each technical school in our country. In 2022, the highest number of students studying in the technical schools was recorded in the Samarkand region (11500), and the minimum rate was 2200 students in the Syrdarya region.

There are 159 higher education institutions in our country. These include 72 in Tashkent city, and 87 in the regions. Of these, 28 are universities, 47 institutes, 3 academies, 1 conservatory, 26 branches, 30 foreign HEI branches, and 24 are non-state HEI.

## Conclusions

It is known that when organizing educational and community services and many other types of services, we take into account natural and demographic factors. While the population is in the center of the rendered services, in the organization of residential types of services, the requirements and needs of people are taken into account. The correct organization of this field is urgent in the Andijan, Fergana, Samarkand, and Kashkadarya regions, where the demographic potential of our republic is high. In areas with low population density, certain difficulties arise in the development of all types of services, while the density of population is also important in the organization of schools, and preschool institutions, and the level of provision of community services. For example, in Syrdarya province, which is poorly supplied with drinking water, 85% of the population is supplied with clean drinking water due to the relatively high density of smaller numbers of the population.

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*UDC: 94, 930, 930.1, 930.85*

# THE CONCEPT OF LABOR IN BAHOUDDIN NAQSHBAND’S IDEAS (PHILOSOPHICAL ANALYSIS)

**Jumayev Aslam Khazratovich**
*Scientific candidate at the Institute of the Ministry of Internal Affairs of the Republic of Uzbekistan*

**Annotatsiya.** Mazkur maqolada Bahouddin Naqshband g‘oyalarida mehnat konsepsiyasi yoritilgan. Tariqatlar tasavvufning amaliy ko‘rinishi bo‘lib, o‘ziga xos uslub va qoidalar bilan insonni kamolotga yetkazishga xizmat qilgan. Naqshbandiya tasavvufiy ta’limotidagi eng muhim masala inson va uning kamoloti masalasidir.

***Kalit so‘zlar:*** *mutafakkir, tariqat, naqshbandiya, nafs, mehnat, axloqiy tarbiya.*

**Аннотация.** В данном состоянии зарождается концепция труда в идеологиях Бахауддина Накшбанда. Тарикат - практическая форма суфизма, служащая доведению человека до совершенства с помощью естественных методов и правил. Важнейшим вопросом человека суфийского учения накшбандия является вопрос о его совершенстве.

***Ключевые слова:*** *мыслитель, тарикат, Накшбандия, желания, трудолюбие, нравственное воспитание.*

**Abstract.** This article describes the concept of work and its philosophical analysis in the ideas of Bahouddin Naqshband. Tariqa is a practical form of Sufism, which served to bring a person to perfection with their own methods and rules. The most important issue in Naqshbandi Sufi doctrine is the issue of man and his perfection.

***Keywords:*** *thinker, tariqah, Naqshbandi, ego, work, moral education.*

## Introduction

In the VIII-IX centuries, a mystical movement arose - Sufism. Sufism (from Arabic suf - coarse woolen fabric, hence - hair shirt as an attribute of an ascetic), a mystical movement in Islam. It arose in the 8th -9th centuries, and finally took shape in the 10th -12th centuries. Sufism is characterized by practice, the doctrine of a gradual approach through mystical love to the knowledge of God (in intuitive insights) and merging with him.

The Sufi had to go through a difficult and long path of religious and moral self-improvement, spiritual purification and self-deepening, and renunciation of the worldly self. Sufism was based on secret knowledge, thanks to which the individual received the opportunity to improve himself and gained experience in dealing with broad temptations. One of the founders of such mystical sects is Bahouddin Naqshbandi [1].

By the 13th-14th centuries, Sufism had reached its peak, both from a theoretical and scientific perspective and from a practical movement perspective. There are many orders in Sufism. In Central Asia, the Naqshbandi order has been widespread for a long time. The Naqshbandi order has developed new educational methods in terms of its content and essence. Also, the teachings of Sufism in the Naqshbandi order, with its social, spiritual, and ideological nature, expressed religious and ethnic tolerance. The Naqshbandi order is a religious order that promotes the education of a perfect person and is recognized by all mankind.

In the history of the peoples of the East, the teachings of Sufism served to educate the perfect person by promoting the ideas of hard work, humanity, the pursuit of knowledge and enlightenment, and love for all of creation, based on the mystical teachings created by Bahouddin Naqshband [2].

The Naqshbandi order, which was widespread in Central Asia and had a stronger influence than the Yasawi order, spread to India and Istanbul from the 15th century. According to sources, the Naqshbandi order spread widely in the Turkish state in the 18th century as a result of the efforts of Mawlana Khalid Baghdadi and became the most active movement. Today, the existence of 65 Naqshbandi schools in Istanbul alone is evidence of the widespread nature of this order.

## Literature Review

The emergence of the Khojagon-Naqshbandi order is explained as follows in terms of orders. Khoja Abdulkhaliq Gijduvani was born in 1103 in the city of Gijduvan, Bukhara region. Abdulkhaliq Gijduvani is recognized as the fourth disciple of Khoja Yusuf Hamadoni. It is also recognized in many sources that the founder of the Yasawiyya order, Khoja Ahmad Yasavi (1141-1167), was a companion and companion of Khoja Yusuf Hamadoni, and that Abdulkhaliq Gijduvani and Khoja Ahmad Yasavi received their Sufi education from Khoja Yusuf Hamadoni and reached perfection. Abdulkhaliq Gijduvani, in his “Maqomati Khoja Yusuf Hamadoni”, described his teacher Khoja Yusuf Hamadoni as perfect in every way and “the sheikh of sheikhs” [3].

Abdulkhaliq Gijduvani is considered the founder of the line of khojas in the Naqshbandi order. The six great pirs of the Khojagon-Naqshbandi order - Abdulkhaliq

Gijduvani, Khoja Orif Revgari, Mahmud Anjir Faghnavi, Khoja Ali Romitany, Muhammad Boboi Samosiy, Amir Kulal, and the founder of the Naqshbandi order, Bahauddin Naqshband, are known to this day in the Muslim world as the "Seven Pirs" [4].

The Naqshbandi doctrine played a very important role in the socio-political, spiritual, and cultural life of the peoples of Central Asia, and the Middle East. This doctrine categorically condemned the exploitation of others, servility, and social oppression. Also, the adherents of this doctrine called for the struggle against worldly life, the oppression and tyranny of the rich and nobles with enlightenment, and the livelihood of the people through honest work. The adherents of the Naqshbandi order called on people to engage in all useful and good works, such as trade, agriculture, crafts, music, science and enlightenment, calligraphy, and painting. That is why such progressive thinkers as Abdurakhman Jomi and Alisher Navoi, who were the great figures of their time, chose the path of the Naqshbandi doctrine.

## Analysis and Results

The most important issue in the Naqshbandi Sufi doctrine is the issue of man and his perfection. The teachings of the Naqshbandi order pay special attention to the essence of man, his unique structure, and the issues of his spiritual and moral perfection. The teachings of Bahouddin Naqshband and the ideas of the Naqshbandi order also focus on such principles as curbing the ego, educating the soul, and controlling and regulating the ego. Bahouddin Naqshband said that a person reaches the level of complete perfection when he reaches the peak of his ego education.

Bahouddin Naqshbandi preached that a person should be the master of his own soul, educate it, and devote all his energy to goodness. He especially emphasized the issue of honest work and recommended honest labor.

According to the Naqshbandi doctrine, a person who chooses the path of repentance is free from the affliction of the soul. That is, his heart is constantly occupied with remembrance and his hands are engaged in work. He refrains from sleeping in vain, talking in vain, and eating in vain. This leads a person to physical and spiritual perfection [5].

In the Naqshbandi teachings, the cultivation of the soul under the motto of "Doing honest work without forgetting the Truth," that is, "The first thing you see is the heart, the heart is yours," encouraged the followers of the order to avoid gluttony, work honestly, and earn a living honestly. Unlike Naqshbandi, in many orders, dervishes have also been observed to retreat to the desert, live off their work, beg, and gluttony, and cultivate their souls while remaining calm [6].

Bahouddin Naqshbandi's teachings, based on the ideals of hard work, humanity, the pursuit of knowledge and enlightenment, and love for all of creation, served to educate the perfect human being.

Bahouddin Naqshband always advocated an honest life. According to him, one should never abandon one's profession and manual labor while connecting the heart with Allah. One should live a life of poverty, not at the expense of charity, but at the

expense of one's own labor. Therefore, the way of life of Bahouddin Naqshband and the teachings he created are similar to the Sunnah of the Prophet Muhammad.

Bahouddin Naqshband lived his entire life as a farmer. Bahouddin Naqshband also lived his entire life in poverty. He promoted the idea of "Dast-ba koru dil ba yor," which is the original creed of this order, that is, always keep your heart in your work, your heart in Allah. Bahouddin Naqshband liked to earn a living through his own labor and strength and donated his earned wealth to orphans, widows, and the poor. He always tried to stay away from the rulers and never became greedy for them.

The Naqshbandi teachings made a huge contribution to Amir Temur's struggle against Mongol exploitation in Central Asia, his desire to establish an independent state and ensure cultural and spiritual development in it, and the emergence of the Timurid Renaissance. Many scholars, statesmen, and artists of the 15th century widely used the teachings of the Naqshbandi order and had an extremely positive attitude towards this order.

## Conclusions

The orders are a practical manifestation of Sufism, serving to bring a person to perfection with their own methods and rules. While the classical orders emerged in the 12th century, the Khojagan-Naqshbandi order, which emerged in the second half of the 14th century, became one of the classical orders that reflected the common elements of all orders (including the Yasawiya order). At the same time, the Naqshbandi order, like other orders, used its own methods and rules in educating a perfect person. The Naqshbandi order is the last of the classical orders, and therefore it reflects the best aspects of all Sufism and orders.

Bahouddin Naqshband's idea that one can perfectly obey the Creator without abandoning worldly affairs and openly withdrawing from worldly affairs ensured the penetration of Sufism into very wide segments of the population in the Muslim world. Today, Bahouddin Naqshband's tomb in Bukhara is a place of pilgrimage. Many works have been written and scientific studies have been conducted on Bahouddin Naqshband and his teachings, as well as on the Naqshbandi sheikhs.

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# THE NEIGHBORHOOD WORKING SYSTEM IN NEW UZBEKISTAN: A PHILOSOPHICAL ANALYSIS

**Makhmudov Feruz Tulkinovich**
*Scientific candidate at the Institute of the Ministry of Internal Affairs of the Republic of Uzbekistan*

**Annotatsiya.** Mazkur maqolada Yangi O‘zbekistonda mahallabay ishlash tiziminining falsafiy mohiyati yoritilgan. Yurtimizda “Mahallabay” tizimni amaliyotda samarali ishlashini ta’minlash mexanizmlari ishlab chiqilmoqda. Bugungi kunda mahallalarni rivojlantirish va qo‘llab-quvvatlash bo‘yicha respublika, viloyat va tuman (shahar) kengashlari joriy etilmoqda.

***Kalit so‘zlar:*** *Mahallabay ishlash, mahalla, mahalla beshligi, mahalla yettiligi, ijtimoiy himoya.*

**Аннотация.** В данном государстве отражена сущность системы махаллинской работы в Новом Узбекистане. В нашей стране разрабатываются механизмы, обеспечивающие эффективное функционирование системы «Махалля» на пример. Сегодня для развития и поддержки микрорайонов приведены республиканские, областные и районные (городские) советы.

***Ключевые слова:*** *Махаллинская работа, махаллая, “махаллинская пятерка,” “махаллинская семерка,” социальная защита.*

**Abstract.** This article reflects the essence features of the neighborhood work system in New Uzbekistan. In our country, mechanisms are being developed to ensure the effective functioning of the "Mahallabay" system in practice. Today, republican, regional and district (city) councils are being introduced for the development and support of neighborhoods.

***Keywords:*** *neighborhood work, neighborhood, neighborhood five, neighborhood seven, social protection.*

## Introduction

By declaring itself a social state, Uzbekistan is committed to creating conditions for each of its citizens to live a decent life. This means distributing available resources based on the principles of social justice, preventing the development of strong stratification in society, ensuring quality education and healthcare for the most vulnerable, effective social protection programs, supporting citizens with limited opportunities and in need, fair labor legislation and an attractive pension system. In simple terms, children from even the poorest families should have the opportunity to grow up healthy, get a good education, and achieve prosperity.

The wide-ranging reforms being implemented in the new Uzbekistan will not only have a positive impact on the political activism of modern youth, but will also affect the development of their political culture.

The Law of the President of the Republic of Uzbekistan № 406 "On State Youth Policy" dated September 14, 2016 clearly defines the powers of all priority spheres of public life, including the Cabinet of Ministers, local government bodies, education, culture, sports, labor, prosecutor's office, internal affairs, justice bodies and other relevant organizations in the field of state youth policy. In particular, Article 4 of the law noted that the main principles of state youth policy are: openness and transparency; participation of young people in the implementation of state youth policy; support and encouragement of youth initiatives; priority of spiritual, moral, and cultural values; and non-discrimination of young people.

## Literature Review

Today, in our republic, the term "unorganized youth" is replaced by the term "youth notebook". By Resolution № 152 of the Cabinet of Ministers of the Republic of Uzbekistan dated March 19, 2021, the "Mahallabay" work system was put into practice. In this direction, in order to organize targeted, individual and systematic regular work with each person, a completely new system was implemented for families in need of material assistance and support - "Iron Notebook", and for women and young people who need and desire social, economic, legal, psychological support, knowledge and vocational training, respectively, the "Women's Notebook" and "Youth Notebook" systems were implemented. In addition, the Resolution of the Cabinet of Ministers № 312 of June 7, 2022 "On measures to further improve the system for studying and solving youth problems" was a major step in this regard [1].

Trainings for women in need of social protection and psychological support have been organized by the "Women's Advisory Councils" established under all existing citizens' assemblies in our country, involving qualified psychologists. Within the framework of the "Every Family is an Entrepreneur" program, preferential loans are being provided to citizens, and opportunities are being created for citizens to engage in crafts and homemaking.

Working "by neighborhood" is a new mechanism for all sector officials to work together to solve problems in neighborhoods and important issues in the lives of the population [2]. Today, in order to identify and eliminate problems in the regions of our country on a "by neighborhood" basis, in particular, to ensure the implementation of the "Prosperous Village" and "Prosperous Mahalla" programs in the regions, Working Groups consisting of responsible employees of the Ministry of Mahalla and Family Support and its territorial divisions have been formed, and as a result of this practice, many social problems that plague people in the regions are being solved.

## Analysis and Results

In particular, systematic work is being carried out to improve internal roads, drinking water and electricity supply, and irrigation networks in the mahallas. As a result of the

close cooperation of mahalla employees with sector leaders and relevant ministries and organizations, support has been provided to families in need of social protection, employment of women has been ensured, and vocational training is being intensively carried out.

In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 312 dated June 7, 2022 “On measures to further improve the system for studying and solving youth problems”, one-time financial assistance and subsidies of up to 7.2 million soums for learning foreign languages will be provided to young people in difficult financial circumstances. Also, in accordance with the Regulation “On the procedure for systematically solving youth problems and providing them with social support through maintaining the “Youth Book”, approved by this resolution, the following types of assistance will be provided to young people included in the “Youth Book” [3].

In our country, all socio-economic reforms are being implemented based on the social demands of the population. For this, makhallas are given many powers, organizational and financial opportunities. In the conditions of new Uzbekistan, today in makhallas, a “system of five” consisting of a makhalla chairman, an assistant khokim, a women's activist, a youth leader and a preventive inspector are being formed, and later, as a result of the addition of a tax and social service employee, a “mahalla seven” is being formed. The main goal of this is to collectively resolve issues such as registering the needy population, providing material assistance, subsidies and loans, without going to district and regional offices, but in the makhalla itself. Also, today, funds from employment, entrepreneurship and home-based funds are being distributed to each makhalla.

This principle is also an important basis for the "neighborhood" working mechanism being implemented in our country, namely, the integration of representatives of all sectors and a comprehensive approach to solving regional issues.

Citizens living in neighborhoods are being provided with subsidies to develop homesteading and are being provided with training courses. Citizens who have been trained in a profession in training courses are being provided with subsidies to start their own businesses.

In order to ensure the effective operation of the “Mahallabay” system in practice, working groups are being formed on site by employees of the Ministry of Internal Affairs of the Republic of Uzbekistan and Public Security to ensure road safety.

The head of our state emphasized that all socio-economic programs in our country are implemented locally, based on the needs of the population, and for this, many powers, organizational and financial opportunities are given to makhallas. Times are changing rapidly. We need to turn makhallas into institutions that truly solve problems in the localities. We will gain more experience, we will change more. Life is forcing us to do this. If we say that we will find a solution to the current threats, our only way is makhalla, makhalla, makhalla, and once again makhalla. The more we raise the prestige of the makhalla system, the more people will trust us, the more people will be satisfied with us, he said, emphasized, the head of state.

Today, in the “Mahallabay” working system, a permanent representative from responsible employees of commercial banks is assigned to each mahalla, who, together with the mahalla chairmen, study the situation in households, the number of unemployed people, their interests, the “growth points” of the area, and issues of expanding the activities of existing business entities. “Roadmaps” are being developed for the development of each mahalla.

In accordance with the Resolution of the President of the Republic of Uzbekistan № PQ-31 dated December 3, 2021, the activities of a commercial bank and assistants to the governors were established, and in accordance with the Resolution of the President of the Republic of Uzbekistan № PQ-62 dated December 24, 2022, the Department of Neighborhood Work and Entrepreneurship Development and centers were established in the regions to coordinate the activities of assistants to the governors [4].

## Conclusions

In conclusion, in our country, today, the development of neighborhoods is carried out by dividing households into categories: households with low incomes but trying to earn an income, households with a permanent income and wanting to earn additional income, households in need of social protection, households that have lost their breadwinners, and households with disabilities, and households with a good economic situation and self-sufficiency. Special attention is paid to providing employment to youth and women and reducing poverty, and work is being carried out based on specific measures based on the “Mahallabay” system.

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# CONTRASTIVE STUDY OF LINGUISTIC ASPECTS OF THE UZBEK AND KOREAN LANGUAGES

**Musaev Farkhod**
*Senior Teacher, Faculty of Foreign Philology, Urgench State University named after Abu Rayhan Biruni*
farmus2211@gmail.com

**Annotatsiya.** Maqolada o‘zbek va koreys tillarining grammatik va lingvistik xususiyatlari qiyosiy analitik tahlil nuqtai nazaridan ko‘rib chiqiladi. O‘zbek tili aglyutinativ turkumiga mansub bo‘lib, unda so‘z yasashda qo‘shimchalarning roli katta ahamiyatga ega. Koreys tili ham agglyutinativ tildir, lekin uning gap tuzilishi va morfologik tuzilishi o‘ziga xos farqlarga ega. Maqolada har ikki tilning gap yasalish qoidalari, fe'l shakllari, so‘z tartibi va urg‘u jihatlari solishtirilib, o‘xshashlik va farqlar aniq ko‘rsatilgan. Ushbu tadqiqot o‘zbek tilidan koreys tiliga tarjima jarayonlarini osonlashtirish va lingvistik tadqiqotlarda yangi yondashuvlarni taklif qilishda muhim ahamiyatga ega.

***Kalit so‘zlar:*** *o‘zbek tili, koreys tili, grammatika, tilshunoslik, qiyosiy tahlil, aglutinativ tillar, gap tuzilishi, so‘z yasalishi, morfologiya, urg‘u.*

**Аннотация.** В статье анализируются грамматические и языковые особенности узбекского и корейского языков с точки зрения сравнительного аналитического анализа. Узбекский язык относится к агглютиновой семе, в которой роль суффиксов в словообразовании имеет большое значение. Корейский язык также является агглютинативным языком, но его структура и морфологическая структура имеют свои особенности. В государстве сравниваются правила построения предложений, формы глагола, порядок слов и аспекты воздействия обоих языков, видимый уровень сходства и различия. Это важное исследование для облегчения процессов перевода с узбекского на корейский и предложения новых подходов в лингвистических исследованиях.

***Ключевые слова:*** *узбекский язык, корейский язык, грамматика, лингвистика, сравнительный анализ, агглютинативные языки, структура предложения, словообразование, морфология, ударение.*

**Abstract.** This article examines the grammatical and linguistic features of the Uzbek and Korean languages from a comparative-analytical perspective. The Uzbek language belongs to the agglutinative family, in which the role of suffixes in word formation is of great importance. The Korean language is also an agglutinative language, but its sentence structure and morphological structure have their own differences. The article compares the sentence structure rules, verb

forms, word order and stress aspects of both languages, clearly showing similarities and differences. This study is important for facilitating Uzbek-Korean translation processes and proposing new approaches in linguistic studies.

***Keywords:*** *Uzbek language, Korean language, grammar, linguistics, comparative analysis, agglutinative languages, sentence structure, word formation, morphology, stress.*

## Introduction

The language of each nation is a unique treasure that reflects its history, culture and worldview. Language is not only a means of communication, but also a phenomenon closely related to the history of human thought and the development of society. Although the Uzbek and Korean languages were formed in two different geographical and cultural environments, comparing them opens the way to interesting scientific results. The Uzbek language, with its literary heritage enriched over the centuries, occupies an important place in the agglutinative language family of Central Asia. The Korean language is distinguished by its centuries-old written traditions and complex structures in East Asia.

The study of the grammatical and linguistic systems of these languages is of great importance not only for comparative linguistics, but also for improving language learning methodologies. For example, the lack of a strict word order in Uzbek, compared to the S-O-V (possession-action-predicate) order in Korean, highlights the differences in thought patterns in different cultures. These differences create many difficulties in the process of mutual translation, but by studying them, problems can be solved.

This article provides an in-depth analysis of the grammatical aspects of the Uzbek and Korean languages, focusing on their similarities and differences. The study of the structural features between these languages, based on linguistic theories, serves to deepen the connections between the two languages and to develop important guidelines for translators.

## Literature Review

The scientific literature on the linguistic features of the Uzbek and Korean languages presents different approaches. Studies on the grammatical systems and linguistic structures of both languages have been widely studied in such fields as comparative linguistics, typology, and morphology. There are many ideas in the literature about comparing languages, studying their grammatical forms, word formation, sentence structure, and linguistic structures.

Studies on the grammar and syntax of the Uzbek language have been carried out by many prominent linguists. For example, Aripova A. and Ubaydullaeva Z. studied the morphological and syntactic structures of the Uzbek language and clearly expressed the agglutinative features of the morphology of the Uzbek language [1]. Researchers also analyzed the verb forms and sentence structure of the Uzbek language, showing in detail the rigidity and semantic elements in the syntactic structure of this language.

There are extensive studies on suffixes, morphological layers, and approaches to word formation in the Uzbek language.

Studies on the Korean language. There are also various scientific works on the grammatical system of the Korean language. The studies conducted by B. Choi on the morphology and syntax of the Korean language are of great importance [3]. He studied the affixation system and verb forms in Korean word formation and described the unique morphological structures of the Korean language. Research on sentence structure and word order in Korean, in particular, the work of Lee M.J., has extensively studied the S-O-V (possession-verb-predicate) structure in Korean and has deeply analyzed the syntactic rules of this language [5].

Comparative linguistics studies. There are a number of studies in the field of comparative study of Uzbek and Korean languages. V. M. Vorobyev compared Uzbek and Korean languages, bringing out similarities and differences between the languages [6]. They analyzed the affixation systems, morphological structures, and sentence structure rules used in these languages. With the help of comparative analysis, differences in the grammatical structures of Uzbek and Korean languages, but also several similarities, for example, the fact that they are based on agglutinative structures of the two languages, were found.

It is important to take into account grammatical differences between languages in the translation process. The difficulties that arise when translating Uzbek and Korean and ways to overcome them are analyzed in detail in the scientific article by T. Beshimov [2]. These scientific works provide translators with recommendations on how to overcome the differences in the grammatical systems of the two languages and correctly convey the meaning.

There are other researchers who have conducted comparative analysis between Uzbek and Korean. Their works compare the morphology, syntax, lexical system and pragmatic features of the two languages. They also analyze the communication, interactions and connections between cultures between languages. These studies also pay attention to the linguistic, cultural and social aspects of language learning. An analysis of the literature on Uzbek and Korean shows that comparative analysis between the two languages creates new opportunities in linguistic research. There are many studies on the grammatical systems, word formation, syntax and pragmatic aspects of the Uzbek and Korean languages, which help to shed light on the similarities and differences between the languages. At the same time, new methods for solving difficulties and problems that arise in the process of translation between the two languages are proposed through the literature.

*Linguistic analysis:* Linguistic comparison of Uzbek and Korean languages allows us to identify the peculiarities of their various grammatical structures and means of expression. Both languages belong to the agglutinative language family, which indicates that they have certain similarities in word formation and suffix systems. However, these suffixes and their syntactic functions differ significantly in both languages.

Verb forms and word order. In Uzbek, word order is relatively free, and the content of the sentence is often determined by the combination of conjunctions and words. For example:

• Kitobni o'qidi — O'qidi kitobni.

In Korean, the strict S-O-V (possessor-object-verb) structure is used:

• 학생이 책을 읽었다 (Haksaengi chaeg-eul ilg-eotda) — "The student read the book."

This difference between the two languages shows the importance of word order in the translation process. In Uzbek, the verb may not come at the end of the subordinate clause, while in Korean this rule is strictly followed.

Morphology and affixation system. In Uzbek, word formation and the expression of grammatical meaning are mainly carried out using suffixes. For example, forms such as uchit, uchit, uchit ɔtot indicate plural, possessiveness, and other grammatical meanings. Korean also has an affixation system, but its suffixes determine the functions of verbs and nouns more. For example:

- 학생 (haksaeng) — "student,"
- 학생이 (haksaengi) — "student" (possession),
- 학생을 (haksaengeul) — "student" (filler).

Stress and phonetic aspects. In Uzbek, stress falls on the last syllable of a word, which provides a certain rhythmic harmony in the pronunciation of words. In Korean, stress is expressed more through changes in the tone of syllables, which can cause problems in pronunciation. In Uzbek, the word "yozuvchi" differs from the word "yozuv" in stress, while in Korean such differences are given through intonation nuances.

Prepositions and postpositions. In Uzbek, auxiliaries (prepositions) come before a verb or noun: "kitob nastavy," "uy tomon." In Korean, postpositions are used:

- 책 위에 (chaeg wi-e) — "on the book,"
- 집으로 (jib-euro) — "towards home."

These analyses clearly demonstrate how the grammatical and linguistic systems of the Uzbek and Korean languages differ from each other. Comparative study of these languages is an important step in the development of not only linguistics, but also cultural dialogue.

## Research Methodology

Many scientific methods and approaches were used in the process of studying the linguistic analysis of the Uzbek and Korean languages. In this study, comparative linguistics methods were chosen as the main approach, using which the grammatical and syntactic systems of the two languages were compared and differences and similarities were identified. The methodological basis of the study includes the following methods:

*Comparative analysis*. The grammatical structures of the Uzbek and Korean languages were compared using the comparative analysis method. This method revealed similarities and differences in the morphological and syntactic systems of the language. Through comparative analysis, which was used to identify the specific features of both languages, important aspects such as structural differences between the languages, word formation, sentence structure and word order were analyzed separately.

Textual analysis. Linguistic analysis was carried out using real texts of the Uzbek and Korean languages, including literary works, newspaper articles and official documents. This method helped to study the use of the two languages in various areas of communication. Through textual analysis, the semantic, morphological and syntactic layers of the language were understood more deeply.

*Corporative analysis*. The practical use of the two languages was analyzed using electronic corpora (language databases) of the Korean and Uzbek languages. Through corporate analysis methods, the use of verbs and nouns in different contexts, similarities and differences in word formation were studied. This method shows how linguistic theory works in real life and increases the reliability of the analysis.

Experimental method. This method was aimed at identifying difficulties in the translation and language learning processes between two languages. Through experiments conducted with language learners and translators in Uzbek and Korean, opinions were collected on the definition of words and grammatical structural features. Through this method, it was possible to see how linguistic differences at different points in the two languages are reflected in practice.

Translation methodology plays an important role in analyzing the translation process between Uzbek and Korean. With the help of this method, grammatical, semantic and pragmatic features were identified, translation difficulties and successful approaches were analyzed. The translation method allowed us to update the approach to linguistic issues between two languages. These methods used in the study further deepened the linguistic analysis of Uzbek and Korean, revealing in detail the similarities and differences between the two languages. Using this methodology, the grammatical systems, word formation, sentence construction rules, and other linguistic aspects of the two languages were studied, and how they can be applied to linguistic practice was shown.

## Analysis and Results

Analysis of the specific grammatical and linguistic aspects of the Uzbek and Korean languages allows for a deeper understanding of the differences and similarities between the two languages. The analysis conducted in this study clearly showed the similarities and differences in the morphological, syntactic, and semantic structures of the two languages. These differences are not only related to linguistic structures, but also to culture, historical development, and the social functions of language.

First of all, it is necessary to pay attention to the similarities in the morphological structure of the two languages. Uzbek and Korean are agglutinative languages, which

indicates that their grammatical formation is based on suffixes. In Uzbek, verbs and nouns are formed through suffixes, in the same way, words are formed using affixes in Korean. However, the suffixes used in both languages and the semantic meanings assigned to them are different, which reveals the differences in their morphological systems. For example, in Uzbek, accusative suffixes are widely used, while in Korean, exclamatory and interrogative suffixes are used in a specific way.

Syntactically, the sentence structure of the Uzbek and Korean languages also has similarities, but the syntactic structures of these two languages have their own characteristics. The fact that the predicate (verb) is placed at the end of the sentence structure in Korean, while in Uzbek the verb often comes before the predicate, constitutes a significant difference in the syntactic order of the language. Such differences indicate how both languages affect communication in the process of social communication. Also, the sentence structure and word order in Uzbek and Korean are formed depending on culture and historical traditions. Semantically, the similarities between the two languages are more related to the figurative expressions of the language and social strata. Many words in Uzbek and Korean have cultural and social significance, and their use changes depending on the context and relationships between people. For example, in Korean, a system of showing respect for age is widespread, which affects the verb forms and speech style of this language. In Uzbek, there are similar procedures for showing respect and greetings to the elderly, which determine the semantic layer in the language. The difficulties that arise in the translation process are related to the semantic and pragmatic differences in the Uzbek and Korean languages. The fact that these two languages are based on different grammatical structures requires special methods to correctly convey their meanings. For example, when translating expressions of respect in Korean into Uzbek, sometimes there may be ambiguities or inconsistencies with the social context. Therefore, it is necessary to take into account the cultural characteristics of the language during the translation process.

During the study, the specific grammatical and linguistic structures of the Uzbek and Korean languages were analyzed. The use of the comparative analysis method in identifying similarities and differences showed the specifics of the two languages. At the same time, this analysis allows for a deeper understanding of translation between languages, language learning, and intercultural communication. Such studies will help people studying the Uzbek and Korean languages to better understand the grammatical, semantic, and pragmatic aspects of the language.

In general, the linguistic analysis of the Uzbek and Korean languages is of great importance not only in linguistics, but also in such fields as cultural studies and sociolinguistics. These studies are necessary for a deeper study of the similarities and differences in the two languages, to ensure more effective communication between the two cultures.

Studies on the grammatical and linguistic aspects of the Uzbek and Korean languages have opened up new opportunities for analyzing the similarities and differences between the two languages. The similarities in the morphological structure, syntax and semantics of the two languages, in fact, are due to the agglutinative nature

of the language, which brings the affix systems of these languages closer to each other. However, the differences in the structures of both languages, especially the nuances in the sentence structure and semantic layer, distinguish their specific features. Syntactic differences, such as the placement of the verb at the end of the sentence in Korean and the fact that the verb often comes before the predicate in Uzbek, indicate interesting and important linguistic differences between the two languages.

Also, semantic differences in Uzbek and Korean are clearly reflected in their social and cultural context. While Korean has a widespread style of speech based on respect and social status, Uzbek also has traditional forms of showing respect to the elderly. Such differences also reflect the pragmatic function of language, since in both languages, meanings are formed according to social significance and change depending on the context.

## Conclusions

In the translation process, it is necessary to take into account grammatical and semantic differences between the two languages to ensure the correct transmission of meaning. Translators' deep understanding of the specific features of the Uzbek and Korean languages is an important factor in strengthening the bridge between the two cultures. Such an analysis will help not only to learn the language, but also to organize dialogue between the two peoples more effectively and correctly.

In addition, these studies are of great scientific importance for those studying the Uzbek and Korean languages, as they combine linguistic and cultural studies. By identifying similarities and differences, communication between the two languages can be more effective and correct. At the same time, linguistic analysis affects not only the scientific, but also the practical aspects of studying the specific features of these languages. As a result, the study of the specific grammatical and linguistic aspects of the Uzbek and Korean languages will be of great importance not only in linguistics, but also in the fields of cultural studies and social sciences. This will allow for the further development of language and intercultural contacts, the conduct of new research, and the deepening of mutual understanding between the two peoples.

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# PUNCTUATION ANALYSIS OF UZBEK TEXTS BASED ON THE N-GRAM MODEL

**Hushnudbek Saylboyevich Adinaev**
*Head of the Educational and Methodological Department*
hushnudbek.adinaev@gmail.som

**Annotatsiya.** Bu ishda biz o‘zbek tili matnlarini tinish belgilarini tahlil qilishni uchun algoritm ishlab chiqishni ko‘rib chiqamiz. O‘zbek tili kam resursli til hisoblangaligi sababali hozirgacha bunday algoritmlar ishlab chiqilmagan. Uzbek tili matnlarini tinish belgilarini tahlil qilish uchun n-gram modelidan foydalangan holda algoritm ishlab chiqilgan. N-gram modeli tabiiy tilni qayta ishlash masalalrini yechishda keng qo‘llaniladi. Masalan, tilning statistic modellashtirishlari so‘zlar berilgan ketma-ketlikda keyingi so‘zni bashorat qilishga qodir. Mazkur ishda Uzbek tili korpusidan N-gram model yordamida navbatdagi so‘zni bashorat qilish (next word prediction) algoritmi ishlatilgan bo‘lib navbatdagi so‘z sifatida tinish belgilar qaralgan.

***Kalit so‘zlar**: O‘zbek tili, til modellashtirish, n-gram, tinish belgilari tahlili, korpus, NLP, o‘zbekcha NLP, keyingi so‘zlarni bashorat qilish, stoxastik usullar.*

**Аннотация.** В данной работе мы рассмотрим метод пунктуационного анализа узбекских текстов. В связи с тем, что узбекский язык считается малоресурсным языком, подобные алгоритмы до сих пор не разработаны. Разработан алгоритм с использованием н-граммной модели для пунктуационного анализа узбекских текстов. Модель н-граммы широко используется для решения задач обработки эстественного языка. Например, язык статистического моделирования может быть предсказан следующим словом в заданной последовательности слов. В данной работе использовался алгоритм предсказания следующего слова из корпуса узбекского языка с использованием н-граммной модели, и в качестве следующего слова рассматривались признаки препинания.

***Ключевые слова.** Узбекский язык, языковое моделирование, н-грамма, пунктуационный анализ, корпус, НЛП, узбекский НЛП, предсказание следующих слов, стохастические методы.*

**Abstract.** In this work, we consider the development of an algorithm for punctuation analysis of Uzbek texts. Due to the fact that the Uzbek language is considered a low-resource language, such algorithms have not been developed so far. An algorithm was developed using the N-gram model for punctuation analysis of Uzbek texts. The n-gram model is widely used to solve natural language processing problems. For example, statistical modeling of language is able to predict the next word in a given sequence of words. In this

work, the next word prediction algorithm was used from the corpus of the Uzbek language using the n-gram model, and punctuation marks were considered as the next word.

***Keywords:*** *Uzbek language, language modeling, N-gram, punctuation analysis, corpus, NLP, Uzbek NLP, next word prediction, stochastic methods.*

## Introduction

Punctuation marks in texts are more important than the words used correctly or the way sentences are constructed. The term “punctuation marks” refers to the system that allows the writer to show the audience where sentences end, whether there is a short pause or a long pause, and whether the writer is asking a question, explaining, or providing additional information. Since the writer is not directly talking to the audience, punctuation marks are the only way for the reader to see what the author is saying.

Punctuation marks are important graphic tools that serve to correctly, expressively, and logically present written speech in a particular language, to summarize it, and to show the logical and grammatical relationships between parts of written speech (sentences) [1]. The main function of punctuation marks is to indicate the semantic division of speech, as well as to help determine its syntactic structure and intonation.

There are 10 punctuation marks in the current Uzbek script: period, question mark, exclamation mark, comma, parentheses, dash, colon, semicolon, and quotation mark. Most of them appeared in the second half of the 19$^{th}$ century with the publication of some newspapers and lithographed books.

Currently, algorithms and methods for punctuation analysis have been created in developed languages, and they are being used in text analysis. The issue of punctuation analysis for the Uzbek language has not been resolved to this day. Therefore, in this work, the n-gram model is used to develop models and algorithms for punctuation analysis of Uzbek texts.

In natural language processing, n-grams are a connected sequence of n elements in a given sample of text or speech. These elements can be characters, words, or other units of text, and are used to analyze the frequency and presence of linguistic patterns in a given sample. The following example shows the construction of n-grams:

I am going to school today.

Gram 1: (“I”, “today”, “to school”, “I am going”)

Gram 2: (“I am today”, “to school today”, “I am going to school”)

Gram 3: (“I am going to school today”, “I am going to school today”)…

A 2-gram, also known as a “bigram,” is a group of two words that are next to each other in a sentence, such as “Natural Language” or “Language Processing.” A 3-gram is a group of three words that are close together. For example, “natural language processing” or “language processing models” are 3-grams. N-grams are useful for many natural language processing tasks, such as language modeling, machine translation, and sentiment analysis, because they show how words and phrases in text fit into the local context. They are also used in information retrieval systems, where

they can be used to match search queries with relevant documents based on the common n-grams.

## Literature Review

Punctuation prediction is an important task in spoken language translation. The output of speech recognition systems usually does not include punctuation. This paper analyzes different methods for predicting punctuation and shows that the quality of the final translation is improved. Furthermore, this paper systematically combines the hypotheses of all the different approaches and achieves an additional improvement of 0.4 points in BLEU [1]. Next-word prediction is an input technology that simplifies the typing process by suggesting the next word for the user to choose, as typing in a conversation takes time. Several previous studies have focused on the Kurdish language, including the use of next-word prediction. However, the lack of a Kurdish text corpus poses a challenge. In addition, the lack of a sufficient number of N-grams for the Kurdish language, for example, five grams, is the reason why the next-word prediction in Kurdish is rarely used. The N-gram model has been used to predict the next words to reduce typing time in Kurdish. In addition, little work has been done on predicting the next Kurdish words; therefore, an N-gram model is used to accurately suggest text. R programming and RStudio are used to create the program for this. The model achieved 96.3% accuracy [2]. This paper describes the contribution to the SEPP-NLG general task of segmenting multilingual sentences and predicting punctuation marks. The goal of this task is to train NLP models that can predict end-of-sentence (EOS) and punctuation marks in automatically generated or transcribed texts. These tasks demonstrate the benefits of cross-language transfer by successfully applying multilingual deep language models. The multilingual models achieved an average F1 score of 0.94 for EOS prediction and an average F1 score of 0.78 for punctuation prediction on English, German, French, and Italian texts [3]. Predicting the most likely word to choose immediately is one of the most valuable ways to enhance the communication experience. With the growth of mobile technology and the widespread use of the Internet, communication has become much easier. People around the world spend more time on their mobile devices for email, social networking, banking, and various other activities. Since such conversations are fast-paced, it is necessary to save as much time as possible while typing. Therefore, a predictive text application is needed for this. Text prediction is one of the most common ways to increase the speed of communication. However, in this case, the speed of text prediction is also very important. The goal of this work is to develop and implement a new word prediction algorithm that suggests words that are more grammatically correct, less burdensome for the system, and significantly reduces the number of keystrokes required by users. The predictor uses a probabilistic language model based on the N-gram methodology to predict text [4]. The output from most automatic speech recognition systems is a continuous sequence of words without proper punctuation. This reduces human readability and the performance of natural language processing tasks on ASR text. The task of predicting punctuation marks, as well as the task of determining the sequence,

is considered and an architecture using pre-trained BERT setups is proposed. This model significantly improves the state of the art on the IWSLT dataset. An overall F1 of 81.4% was achieved for the combined prediction of full stops, commas, and question marks [5]. Uzbek texts were analyzed for punctuation based on the rule [6].

## Research Methodology

Language modeling is a method of determining the probability of any sequence of words. Language modeling is used in various applications such as speech recognition, spam filtering, etc. Language modeling is the main goal of implementing the most modern models of natural language processing.

### *Language Modeling Methods*

Two methods of language modeling:

Statistical Language Modeling: Statistical language modeling or language modeling is the development of probabilistic models that can predict the next word in a sequence given previous words. Examples include N-gram language modeling.

Neural Language Modeling: Neural network methods are achieving better results than classical methods, both on standalone language models and when the models are incorporated into larger models for complex tasks such as speech recognition and machine translation. The method of implementing a neural language model is word embedding.

### N-gram

An n-gram can be defined as a sequence of n elements in a given sample of text or speech. The elements can be letters, words, or key pairs, depending on the application. N-grams are typically collected from a text or speech corpus (a multi-text data set).

For example, N-grams can be unigrams (“This”, “article”, “is”, “on”, “NLP”) or bigrams (“This article”, “article is”, “is on”, “on NLP”).

N-gram language model

An N-gram language model predicts the probability of a given n-gram in any sequence of words in a language. A well-designed n-gram model can effectively predict the next word in a sentence, essentially determining the value of p(w|h), where h is the history or context and w is the word to be predicted.

Let’s look at how to predict the next word in a sentence. We need to calculate p (w|h), where w is a candidate for the next word. Consider the sentence “This article is on…”. If we want to calculate the probability that the next word is “NLP”, the probability can be expressed as:

p(“NLP”|“This”, “article”, “is”, “on”)

To generalize, given the first four, the conditional probability of the fifth word can be written as:$p(w5|w1,w2,w3,w4)$ or $p(W)=p(wn|w1,w2,\ldots,wn-1)$

***This is calculated using the probability chain rule:***

$P(A|B)=\frac{P(A\cap B)}{P(B)}$ and $P(A\cap B)=P(A|B)\,P(B)$

***Now generalize this for the probability of a sequence:***

$P(X1,X2,\ldots,Xn)=P(X1)P(X2|X1)P(X3|X1,X2)\ldots P(Xn|X1,X2,\ldots,Xn-1)$

***This will give the result:***

$P(w1,w2,w3,\ldots,wn)=\prod_i P(wi|w1,w2,\ldots,wi-1)$

We simplify the formula by using Markov assumptions, which imply that the future state depends only on the current state, not on the sequence of events that preceded it:

$P(wi|w1,w2,\ldots,wi-1)\approx P(wi|wi-k,\ldots,wi-1)$

For the unigram model (k=0), this further simplifies:

$P(w1,w2,\ldots,wn)\approx\prod iP(wi)$

And for the bigram model (k=1):

$P(wi|w1,w2,\ldots,wi-1)\approx P(wi|wi-1)$

We will create a dataset by identifying all punctuation marks in the text provided in the link below using a bigram model.

## Analysis and Results

To test the accuracy of the developed algorithm, we used a developed corpus of Uzbek texts in 30 categories, consisting of 137 848 sentences and 1 642 860 words. The results for the corpus are presented in the tables below.

**Table 1.**

| № | Number of periods | period | | not period | | F1 Score |
|---|---|---|---|---|---|---|
| | | period | Not period | period | Not period | |
| 1 | 125824 | 76623 | 12582 | 10265 | 26354 | 87% |

**Table 2.**

| № | Number of commas | comma | | not comma | | F1 Score |
|---|---|---|---|---|---|---|
| | | comma | not comma | comma | not comma | |
| 1 | 113910 | 68991 | 11391 | 9265 | 24263 | 87% |

**Table 3.**

| № | Number of question marks | question mark | | not question mark | | F1 Score |
|---|---|---|---|---|---|---|
| | | question mark | not question mark | question mark | not question mark | |
| 1 | 7480 | 4830 | 748 | 648 | 1254 | 87% |

**Table 4.**

| № | Number of colons | colon | | not colon | | F1 Score |
|---|---|---|---|---|---|---|
| | | colon | not colon | colon | not colon | |
| 1 | 8937 | 4566 | 894 | 796 | 2681 | 84% |

**Table 5.**

| № | Number of ellipses points | ellipses points | | not ellipses points | | F1 Score |
|---|---|---|---|---|---|---|
| | | ellipses points | not ellipses points | ellipses points | not ellipses points | |
| 1 | 5244 | 2721 | 524 | 425 | 1573 | 85% |

**Table 6.**

| № | Number of semi colons | semi colons | | not semi colons | | F1 Score |
|---|---|---|---|---|---|---|
| | | semi colons | not semi colons | semi colons | not semi colons | |
| 1 | 8980 | 4590 | 898 | 798 | 2694 | 84% |

**Table 7.**

| № | Number of dashes | dash | | not dash | | F1 Score |
|---|---|---|---|---|---|---|
| | | dash | tire emas | dash | not dash | |
| 1 | 9220 | 4687 | 922 | 845 | 2766 | 84% |

**Table 8.**

| № | Number of exclamation marks | exclamation mark | | not exclamation mark | | F1 Score |
|---|---|---|---|---|---|---|
| | | exclamation mark | not exclamation mark | exclamation mark | not exclamation mark | |
| 1 | 3493 | 1125 | 349 | 235 | 1784 | 79% |

**Table 9.**

| № | Number of quotation marks | quotation mark | | not quotation mark | | F1 Score |
|---|---|---|---|---|---|---|
| | | quotation mark | not quotation mark | quotation mark | not quotation mark | |
| 1 | 593 | 194 | 59 | 162 | 178 | 63% |

**Table 10.**

| № | Number of parentheses | parentheses | | not parentheses | | F1 Score |
|---|---|---|---|---|---|---|
| | | parentheses | not parentheses | parentheses | not parentheses | |
| 1 | 15575 | 5781 | 1558 | 3564 | 4673 | 69% |

## Conclusions

Since algorithms and models for analyzing punctuation marks for Uzbek texts have not yet been developed, the algorithm proposed in this work opens the way to exploring more ways to approach the task. In this work, an algorithm and model based on the n-gram model are proposed for analyzing punctuation marks. Analyzing and generating the correct use of punctuation marks requires a high level of knowledge of the syntactic and morphological properties of the language, especially if the language is highly agglutinative, such as our Uzbek language. The results of our experiments with the developed corpus of 1 642 860 words in 30 different fields show that the newly created punctuation mark analysis/correction model yielded an accuracy rate of almost 81%.

1) Combining an n-gram model with a rule-based algorithm can yield even better results.
2) Artificial intelligence algorithms should also be supported.
3) This algorithm can be applied to other languages as well.

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# CREATING A RULE-BASED QUESTION-ANSWERING SYSTEM IN UZBEK: AN EXAMPLE OF THE UNIVERSITY ADMISSION PROCESS

**Kurbonova Ruzikajon Ulug‘bek Kizi**
*Doctorate Student, Urgench State University named after Abu Rayhan Biruni*
ruzikajonqurbanova0809@gmail.com

**Sharipov Maksud Siddiqovich**
*Docent (PhD), Urgench State University named after Abu Rayhan Biruni*
maqsbek72@gmail.com

**Annotatsiya.** Ushbu maqola oliy ta’lim muassa (OTM)lariga qabul jarayonida yuzaga keladigan savollarga avtomatik javob berish maqsadida o‘zbek tilida qoidaga asoslangan savol-javob tizimini yaratish masalasi ko‘rib chiqiladi. Tizim foydalanuvchilarning savollarini morfologik shakllarini normallashtirish (lemmatizatsiya) yordamida qayta ishlaydi va qoidalar asosida mos javoblarni aniqlaydi. OTMlardagi qabul jarayoniga oid savollar asosida tizim ariza topshirish tartiblari, hujjat talabnomalari, imtihon shakllariga oid 400 dan ziyod savollarni qamrab oladi. Python dasturlash tilida dasturiy ta’minoti ham ishlab chiqildi. Mos keluvchi savolni topishda Jaccard o‘xshashligidan foydalanildi. Ushbu maqolada tizim arxitekturasi, qoidalar bazasi va javob hosil qilish mexanizmi batafsil yoritilib, uning samaradorligi hamda kelgusidagi gibrid yondashuvlar imkoniyatlari muhokama qilinadi.

***Kalit so‘zlar:*** *Qoidaga asoslangan savol-javob tizimi, Lemmatizatsiya, Oliy ta’limga qabul, Tabiiy tilni qayta ishlash, Jaccard o‘xshashligi.*

**Аннотация.** Эта статья рассматривает вопросы создания на узбекском языке системы вопросов и ответов, основанной на правилах, с целью автоматического ответа на вопросы, возникающие в процессе поступления в высшие учебные заведения (ВУЗы). Система обрабатывает вопросы пользователей, нормализуя морфологические формы (лемматизация), и определяет соответствующие ответы на основе правил. На основании вопросов, связанных с процессом поступления в ВУЗы, система ограничивает более 400 вопросов, касающихся порядка подачи заявлений, требований к документам и форме экзаменов. Программное обеспечение системы разработано на языке программирования Phyton. Для поиска подходящего вопроса использовалось сходство Jaccard. В государстве подробно освещаются архитектурные системы, основы правил и механизма формирования ответов, а также обсуждается ее эффективность и возможности применения гибридных подходов в будущем.

***Ключевые слова:*** *Система вопросов-ответов на основе правил, Лемматизация, Прием в университет, Обработка естественного языка, сырье Jaccard.*

**Abstract.** This article examines the issue of creating a rule-based question-and-answer system in the Uzbek language aimed at automatically responding to questions arising during the admission process to higher education institutions (HEIs). The system processes users’ questions by normalizing their morphological forms (lemmatization) and identifies appropriate answers based on rules. Drawing on questions related to the admission process in HEIs, the system covers more than 400 questions regarding application procedures, document requirements, and examination formats. The system’s software was developed using the Python programming language. The Jaccard similarity method was employed to find matching questions. The article provides a detailed discussion of the system’s architecture, rule base, and answer generation mechanism, while also evaluating its effectiveness and exploring possibilities for hybrid approaches in the future.

***Keywords:*** *Rule-Based Question Answering, Lemmatization, University Admission, Natural Language Processing, Jaccard similarity.*

## Introduction

Today, the increasing abundance of information and the expansion of digital information resources have led to a growing demand for question-answering (QA) systems. Particularly in complex and information-intensive fields such as higher education admissions processes, the ability to provide quick and accurate responses to a wide range of inquiries-including application submission, document preparation, exam procedures, payment contracts, scholarships, dormitories, and more is critically

important. In university admissions, the sheer volume, standardized nature, and repetitive characteristics of applicant queries often make traditional manual response methods time- and resource-intensive. Consequently, automated QA systems, especially those based on rule-based approaches, have emerged as a timely solution to streamline and enhance the efficiency of this process.

This article analyzes the experience of developing a rule-based QA system for the Uzbek language, using its application in university admissions as a case study. The system normalizes user questions through lemmatization, reducing words to their base morphological forms. This process plays a vital role in identifying the semantic essence of a question, enabling accurate processing of differently phrased queries (e.g., "How do I submit documents?") through a unified rule base. The core modules of the system include: a preprocessing module, a rule base, and response generation.

The advantages of a rule-based system—such as its understandable and easily modifiable structure, low computational costs, and domain-specific adaptability—make it an ideal solution for university admissions. However, it also faces limitations in scalability and handling ambiguous or context-dependent queries. The primary goal of this work is to demonstrate the efficacy of a rule-based QA system for the Uzbek language in simplifying admissions processes and to outline future directions for its development.

## Literature Review

Natural Language Processing (NLP) enables computers to understand and respond to questions posed in natural language [1]. This phenomenon is referred to as Question Answering (QA). QA is one of the most challenging problems in NLP and AI, often termed an "AI-complete" problem. In this field, researchers such as Riloff and Thelen (2000) [2], Jain and Dodiya (2014) [3], Veisi and Shandi (2020) [4], and others have attempted to develop robust QA systems using diverse techniques, including rule-based and statistical approaches. However, all these methods have specific limitations. For instance, most developed systems are not open-domain, meaning they perform well only within their trained domains.

Rule-based QA systems, with decades of research behind them, offer key advantages such as simplicity, transparent algorithms, and ease of modification. For the Uzbek language, lemmatization plays a critical role in rule-based systems [5], as the language's morphological richness and the diverse inflectional forms of words pose challenges in accurately understanding the semantic meaning of questions. However, there remains insufficient research in this area for Uzbek. While Zhong et al. (2024) [6] highlight the challenges of applying lemmatization in low-resource languages, this method is still considered an effective solution for unifying question forms.

Turning to Turkic languages, Mohammed Akour's work [7] presents a QA system for Arabic, designed to answer reading comprehension test questions automatically. This system accounts for Arabic's complex morphological features and the lack of diacritical marks, using rule-based methods to classify question types, including "How" and "Why" questions. The system achieved an overall accuracy of 84%,

outperforming existing Arabic QA systems. For Turkish, Kerem Celik proposes a rule-based approach focused on identifying the "focus" of questions. Given Turkish's free word order and intricate morphology, the study demonstrates how dependency parsers and rules can extract core question elements [8, 9].

## Research Methodology

The system has been integrated with over 400 questions related to the university admissions process. These questions cover topics such as application submission, document submission, exam procedures, payment contracts, scholarships, dormitories, and other relevant themes.

*Experimental Settings*

The evaluation of our system was conducted using a corpus of 400+ questions extracted from the *"Qabul_savollari.xlsx"* file. The following steps were executed:

- Questions were read from the Excel file and lemmatized.
- Questions were compared using the Jaccard similarity metric.
- The lemmatized form of a user's input question was matched against the corpus, and the answer linked to the question with the highest similarity score was returned.

## Analysis and Results

*Preprocessing and Lemmatization*

The first stage of our system involves reading, cleaning, and lemmatizing questions from the existing corpus. This process reduces words' diverse morphological forms to their unified root, enabling a precise understanding of the semantic essence of a question. For example, variations like *"hujjat topshirmoq"* (submitting documents) and *"hujjat topshirish"* (document submission) are normalized to the root *"hujjat topshir"* (submit documents), ensuring consistent semantic interpretation.

*Rule-Based Approach and Answer Selection*

When a user inputs a question, it undergoes lemmatization. The lemmatized version is then compared to questions in the preprocessed corpus using **Jaccard similarity**, which measures overlap between token sets. The system selects the answer linked to the question with the highest similarity score. For instance:

- User Input: *"Abituriyentlar hujjat topshirishda nima qilishlari kerak?"* (What should applicants do when submitting documents?)
- Matched Question: *"Abituriyentlar hujjat topshirish jarayonida nima qilishlari kerak?"* (What should applicants do during the document submission process?)
- Similarity Score: 85.71% → Correct answer retrieved.

*Core Modules of the System*

The system consists of the following modules:

- Preprocessing: Reads, cleans, tokenizes, and lemmatizes question texts.
- Rule-Based Matching Calculation: Normalizes and compares questions using Jaccard similarity.

- Answer Selection: Identifies the best-matching question and delivers the corresponding answer to the user.

**Table 1.** System Architecture and Core Modules.

| Module Name | Task | Main Methods & Techniques |
|---|---|---|
| **Data Acquisition** | Loading and preparing the admissions-related Q&A corpus | Reading data from Excel files (pandas) |
| **Preprocessing** | Tokenizing questions and normalizing morphological forms via lemmatization | UzbekLemma library, tokenization, lemmatization |
| **Rule Matching** | Applying rules and determining matches based on Jaccard | Jaccard similarity, rule-based comparison |
| **Response Generation** | Selecting the best-matching question and delivering the answer to the user | Choosing the question with the highest similarity score |

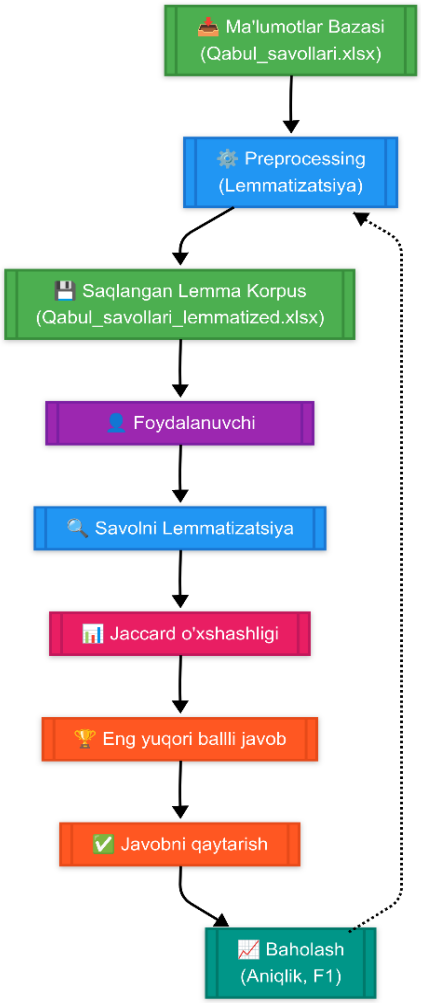


**Figure 1.** Rule-Based QA System Architecture for University Admissions

*Experimental Results*

1. Jaccard Similarity:

This method calculates similarity based on the ratio of intersection to union between token sets. For example, a high similarity index between a user's question and a corpus question flags the latter as the best match.

2. Interactive Testing:

The system accepted user questions interactively and generated responses in low latency, demonstrating its real-time processing capability.

3. User Satisfaction:

Users highly rated the system's simple rule-based logic, low computational overhead, and clear module interfaces.

*Analysis Findings*

- The rule-based approach effectively normalized questions and identified relevant answers.
- Jaccard similarity enabled precise textual comparisons, enhancing match accuracy.
- Efficient code and module integration ensured rapid system performance.
- Future plans include upgrading modules via hybrid approaches (combining rule-based and statistical methods) for improved scalability.

## Conclusions

In this study, we presented the development of a rule-based question-answering (QA) system for automatically responding to university admissions-related queries in the Uzbek language. The system normalizes questions through lemmatization [10], identifies the most relevant question in the corpus using the Jaccard similarity method, and selects the corresponding answer. Experimental results demonstrated the system's ability to deliver fast, efficient, and user-responsive performance [11].

Compared to other systems, the advantages of the rule-based approach low computational costs, simple and transparent algorithms, and ease of domain-specific customization were evident [12, 13]. However, the system also revealed limitations in handling ambiguous or deeply contextual queries. Future work plans to enhance its efficacy by integrating hybrid approaches that combine semantic analysis with statistical methods [14].

Overall, this system serves as an effective tool for simplifying and automating QA challenges in university admissions. Its ability to deliver high performance in low-resource language environments like Uzbek creates broad opportunities for deploying similar QA systems in other linguistically constrained contexts.

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*UDC: 37, 378, 37.09, 374*

# THE EFFECT OF PEER TUTORING ON COLLABORATIVE LEARNING

**Khalilova Nasiba Djamolovna**
*PhD student, Navoi State University*
n_djamolovna@mail.ru

**Annotatsiya.** Ushbu tadqiqot tengdosh repetitorlikning talabalar va o‘qituvchilar o‘rtasidagi vositachi sifatidagi rolini o‘rganib, ularning ishtiroki o‘quv yutuqlari, sinf dinamikasi va ta’lim natijalariga qanday ta’sir qilishini tahlil qiladi. O‘zaro repetitorlik ta’lim sohasida katta ilmiy e’tiborni jalb qildi. Bu inklyuziv ta’lim uchun muhim o‘qitish usuli hisoblanadi, chunki u jamoaviy o‘qitishning asosiy elementi hisoblanadi.

***Kalit so‘zlar:*** *tengdosh repetitorlik, hamkorlikda o‘qitish, o‘quvchilarni jalb qilish, o‘quvchilarni rag‘batlantirish, repetitorlik dasturlari, ta’lim psixologiyasi.*

**Аннотация.** В данном методе обучения роль репетиторов в качестве посредников между студентами и преподавателями анализируется, как их участие влияет на академическую состоятельность, динамику в классе и результаты обучения. Репетиторство среди коллег привлекает значительное академическое внимание в сфере образования. Она считается необходимым необходимым подходом к преподаванию для инклюзивного образования, посколку представляет собой ключевой элемент совместного обучения.

***Ключевые слова:*** *Взаимное репетиторство, совместное обучение, понятность учащихся, мотивация учащихся, взаимное обучение, программы репетиторства, психология.*

**Abstract.** This study examines the role of peer tutors as intermediaries between students and educators, analyzing how their involvement influences academic achievement, classroom dynamics, and learning outcomes. Peer tutoring has attracted significant academic attention within the education sector. It is a vital teaching approach for inclusive education, as it represents a key element of collaborative learning.

***Keywords:*** *Peer tutoring, collaborative learning, student engagement, student motivation, peer-assisted learning, tutoring programs, educational psychology.*

## Introduction

Peer tutoring occurs when individuals from the same social group or academic level assist one another in learning, typically with one peer possessing more knowledge or experience. These tutoring interactions can vary from structured teaching environments within classrooms to informal exchanges of information in social settings. Generally, peer tutors support their fellow students either individually or in small groups by extending classroom discussions, fostering effective study habits, assessing academic work, addressing specific challenges, and promoting self-directed learning [1]. This

approach enhances student motivation and facilitates learning for both the student's receiving assistance and the tutors themselves, who gain both knowledge and a sense of empowerment [2]. Furthermore, research suggests that peers play a crucial role in undergraduate education, often exerting a greater influence than academic advisors and instructors [3]. Another key benefit of integrating peer tutoring into academic settings is its cost-effectiveness [4]. As universities and departments face increasing student enrollments without corresponding budget increases for additional faculty, peer tutors offer valuable academic support in overcrowded courses, alleviating some of the instructional burden on faculty members. It is considered one of the most effective teaching approaches for all students [5].

Numerous universities have incorporated peer tutoring into their programs as an integral part of nationally recognized learning communities designed to support first-year students. These initiatives foster engagement between peer tutors, faculty members, and students in both academic and social settings. The primary goal of such programs is to establish a supportive environment where new students can receive guidance and assistance from their more experienced peers within a structured learning community. Peer tutoring offers various advantages, from academic support to personal mentorship, where tutors leverage their experiences to assist others. Beyond defining the function of peer tutors, it is vital to explore their impact on students, faculty members, and the tutors themselves. By encouraging learners to take responsibility for both their own and their peers' education, peer tutoring increases social engagement and shifts learning from an individual endeavor to a collective experience. Although each tutoring group has its distinct characteristics, certain consistent effects on classroom interactions are observed. Students working together develop a sense of community, learn to appreciate diverse perspectives, and build strong interpersonal relationships. To respond to these challenges, colleges and universities are focusing more deliberately and systematically on undergraduate education, emphasizing student retention and academic performance [6-7]. Several factors contribute to these difficulties, including (a) the prevalence of large lecture-style classrooms, which limit student engagement; (b) the lack of mandatory class attendance, allowing students to take exams without consistent participation; and (c) the tendency for faculty office hours to be dedicated primarily to grade discussions after exams [8]. This collaborative approach to learning enhances problem-solving skills and prepares students for future challenges.

## Research Methodology

The peer tutoring strategy is a teaching method that focuses on students, allowing them to learn in pairs under the guidance of a teacher. To examine the impact of peer tutoring on collaborative learning, a mixed-method approach was used, incorporating both qualitative and quantitative research methods. The study involved two groups of university students: one participating in a structured peer tutoring program and the other following a traditional lecture-based approach [9].

*Data Collection*

The study was conducted among 520 students using online questionnaire and 56 % of respondents were males while 44 % of them female. The quantitative was collected online using Google Forms and the instrument was measured and tested for validity and reliability using SPSS version 26.

These items were measured based on the theories of previous studies of other researchers and tested with this current sample of data, that there was no physical harm, harms to participants' development or self-esteem, stress, harm to career, prospect or future employment, and inducing subject to perform acts [10-11].

These variables with 7 items were tested on their degree of relationship between the items being measured.

*Sample procedure*

In view of the restrictions on the use and availability of official students' personal data from the various institutes of higher learning in Uzbekistan, a non-probability sampling was adopted using the convenience sampling method to collect the data for this study and students who were available to participate in this study at any point in time.

In considering generalization, diversity in the data collected through many different institutions of higher learning was appropriate and useful, thus considered this method for accepting the participants [12-13].

According to [14], the researchers cannot assume the respondents were representatives of the population, thus indicating a limitation of convenience sampling.

Students in the peer tutoring group met twice a week for collaborative learning sessions. Each session focused on reviewing course material, discussing concepts, and solving problems in a cooperative setting.

Informed consent was obtained from all survey participants to ensure that their participation is voluntary and not forced. There was no deception or misrepresentation of the study to the participants.

## Analysis and Results

The experiment was conducted over a semester, during which the experimental group engaged in structured peer tutoring sessions alongside their regular coursework. Peer tutors were selected based on their academic performance and underwent a short training program to develop their mentoring skills. Both groups took periodic tests to measure knowledge retention and comprehension. Online surveys and interviews were conducted to assess students' perceptions of peer tutoring and its effectiveness (see in Table 1). The findings revealed that students in the peer tutoring group demonstrated significant improvements in academic performance compared to those in the traditional learning environment.

Key observations included: (a) Increased confidence and motivation among students who participated in peer tutoring sessions, (b) stronger interpersonal skills and collaboration among students, leading to a more engaging learning experience, (c) qualitative feedback indicated that students found peer tutoring beneficial in clarifying difficult concepts and reinforcing their understanding.

**Table 1.** Percentage of responses per question.
(**SD** – Strongly Disagree; **D** – Disagree; **N** – Neutral; **A** – Agree; **SA** – Strongly Agree)

| Item | Peer Tutoring – Independent Variable 2 | SD | D | N | A | SA |
|---|---|---|---|---|---|---|
| 1 | Peer tutoring of other students can increase one's advancement in learning | 9% | 22% | 18% | 37% | 14% |
| 2 | It increases the motivation and learning of both the peer tutor and the student | 8% | 12% | 16% | 29% | 35% |
| 3 | Peers with expertise and knowledge benefit one another in learning | 11% | 10% | 17% | 35% | 27% |
| 4 | Peer tutoring, results in motivation, learning, and empowerment for tutors | 12% | 15% | 13% | 37% | 23% |
| 5 | Peers have a greater influence on undergraduates than lecturers | 4% | 14% | 25% | 22% | 35% |
| 6 | Helps incoming students with advice from the peer learning community | 6% | 9% | 25% | 29% | 31% |
| 7 | Peer tutoring provides support as counsellors for incoming students | 11% | 19% | 16% | 24% | 30% |

## Conclusions

In conclusion, peer tutoring plays a crucial role in enhancing collaborative learning by promoting engagement, improving academic outcomes, and fostering a sense of community among students. As higher education institutions continue to adapt to diverse learning needs, implementing well-structured peer tutoring programs can be a valuable strategy for improving student success and creating a supportive educational environment. Future research should explore the long-term impact of peer tutoring across different disciplines and examine how technology can further enhance peer-led learning initiatives.

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# THE IMPORTANCE OF STUDENT ENGAGEMENT IN COLLABORATIVE LEARNING

**Khalilova Nasiba Djamolovna**
*Doctorate Student, Navoi State University*
n_djamolovna@mail.ru

**Annotatsiya.** Ushbu maqola talabalarning jamoaviy ta’lim yo‘nalishlarida qamrab olinishi hamda ular ishtirokining ahamiyatiga qaratilgan. Tadqiqot tengdoshlarning o‘zaro munosabatlarini rivojlantirishda jamoaviy topshiriqlarning muhimligini ta’kidlaydi va o‘quvchilarni ta'lim yutuqlarida asosiy ahamiyat kasb etadi, shuningdek, fanni chuqurroq tushunish, tanqidiy fikrlash va ilmiy yutuqlarni rivojlantirishda asos bo‘lib xizmat qiladi. Bundan tashqari, ushbu maqolada talabalarning jamoa ma’suliyatini idrok etish va ushbu muhitda birdamlikni kuchaytirish bo‘yicha muammolar va yondashuvlar ko‘rib chiqiladi. Talabalar ishtirokini ta’minlash ularning motivatsiyasi, mahoratini oshirish va umumiy o‘rganish tajribasiga qanday ijobiy ta’sir ko‘rsatishini yorituvchi keng qamrovli tahlil taqdim etiladi.

***Kalit so‘zlar:*** *Talabalarning faolligi, faol ta’lim strategiyalari, ta’limdagi motivatsiya, ta’lim yutuqlari, aralash metodik tadqiqotlar.*

**Аннотация.** В этом состоянии основное внимание уделяется значению вовлеченности студентов в контекст совместного обучения. В ней рассматривается, как активное участие, общение и командная работа жизненно важны для содействия более глубокому пониманию, критическому мышлению и академическим достижениям. Исследование подтверждает значимость совместных заданий в содействии взаимодействию сверстников и помогает студентам играть активную роль в их образовательных достижениях. Кроме того, в государстве рассматриваются проблемы и подходы к повышению вовлеченности в условия совместной среды, подчеркивающая важность как личной, так и групповой ответственности. Предоставляется всесторонний анализ,

демонстрирующий, как вовлеченность положительно влияет на мотивацию студентов, повышение навыков и общий опыт обучения.

***Ключевые слова:*** *Привлечение студентов, стратегии активного обучения, мотивация в образовании, образовательные достижения, смешанные методы исследования.*

**Abstract.** This article focuses on the significance of student engagement in collaborative learning contexts. It observes how active involvement, communication, and teamwork are vital to fostering deeper understanding, critical thinking, and academic achievement. The research highlights the importance of collaborative assignments in promoting peer interaction and encourages students to take an active role in their educational achievement. Additionally, the article addresses the challenges and approaches to enhancing engagement within collaborative environments, stressing the importance of both personal and group responsibility. A comprehensive analysis is provided, demonstrating how engagement positively influences on student motivation, skill enhancement, and the overall learning experience.

***Keywords:*** *Student engagement, active learning strategies, motivation in education, educational achievement, mixed-methods research.*

## Introduction

Student involvement plays a crucial role in academic success. When students are actively engaged, they pay close attention, contribute to classroom discussions, put effort into assignments, and demonstrate enthusiasm for learning [1]. Conversely, a lack of engagement can lead to disruptive behavior, reduced academic aspirations, lower grades, and an increased likelihood of dropping out [2]. Students who are disengaged tend to adopt a passive approach to learn and often experience boredom, anxiety, or frustration in the classroom [3]. Consequently, the effectiveness of learning largely depends on the degree of student engagement in academic activities [4]. Research has shown that middle school students who exhibit higher engagement levels are 75% more likely to maintain good grades and attend school consistently compared to those with lower engagement [5].

How can educators foster greater student engagement and enhance their academic competence? Traditionally, student engagement and academic success have been perceived as inherent qualities of individual learners rather than as results influenced by teaching methods [6]. Instead of relying solely on teacher qualifications and demographics as indicators of student engagement and performance, factors that have shown only a weak correlation with academic success [7]. Researchers are shifting their focus toward exploring teacher-student interactions and the social dynamics within the classroom that contribute to positive student outcomes [8].

Extensive research has been conducted on the instructional and structural elements of the classroom environment, highlighting the significance of a teacher's capacity to foster critical thinking skills [9], incorporate students' prior knowledge into lessons

[10], and establish clear expectations for the classroom [11]. Another crucial component of teacher-student interactions is the teacher's role in creating a classroom atmosphere that is emotionally supportive and nurturing [12].

## Research Methodology

This study employs a mixed-methods approach, incorporating both qualitative and quantitative data collection techniques to examine the role of student engagement in collaborative learning. A combination of surveys, classroom observations, and academic performance data provides a comprehensive understanding of how engagement levels impact learning outcomes.

The study involves students from diverse academic backgrounds enrolled in undergraduate courses at a university. A total of 210 students from different disciplines were randomly selected to participate, ensuring a balanced representation of various learning styles and academic performance levels.

*Data Collection*

Survey Instrument: A structured questionnaire was distributed to assess students' perceptions of engagement in collaborative learning. The survey included Likert-scale questions measuring motivation, participation, and perceived effectiveness of group activities.

Classroom Observations: Trained observers documented student interactions during group activities, focusing on verbal contributions, collaboration frequency, and engagement intensity.

Academic Performance Analysis: Students' grades and assignment scores were collected to measure the correlation between engagement levels and learning outcomes.

*Ethical Considerations*

All participants provided informed consent, and their responses remained confidential. The study adhered to ethical guidelines to ensure that student participation was voluntary and free from coercion.

## Analysis and Results

To analyze the collected data, several statistical techniques were applied:

*Descriptive Statistics:* Engagement Level: Mean = 3.00, Standard Deviation = 1.41, Range = 1 to 5. Academic Performance: Mean = 74.37, Standard Deviation = 14.72, Range = 38.48 to 100

*Correlation Analysis:* Pearson's Correlation Coefficient (r) = 0.784. p-value = 4.83e-45 (Highly significant). Interpretation: There is a strong positive correlation between engagement level and academic performance, meaning higher engagement tends to be associated with better academic results.

*Regression Analysis:* Academic Performance = 49.82 + (8.18 × Engagement Level)

R-squared = 0.615, indicating that 61.5 % of the variation in academic performance can be explained by engagement levels. Significance: The p-value for the engagement level coefficient is <0.0001, confirming a statistically significant relationship.

*ANOVA (Analysis of Variance):* F-statistic = 82.47, p-value = 1.30e-41 (Highly significant). Interpretation: There are significant differences in academic performance among different engagement levels.

These results confirm that student engagement has a statistically significant impact on academic performance, supporting the importance of fostering engagement in collaborative learning environments.

## Conclusions

The research highlights the necessity of designing classroom environments that encourage both individual and group responsibility, ensuring that students remain motivated and actively involved in the learning process. Students who engage more in collaborative activities tend to perform better academically, as confirmed by statistical analyses indicating a strong positive correlation between engagement levels and academic outcomes. Moreover, it reinforces the importance of effective teacher-student interactions and structured instructional strategies in sustaining student engagement.

Despite the evident benefits, challenges remain in maintaining consistent engagement across diverse student groups. Therefore, educators must adopt innovative pedagogical approaches that cater to different learning styles, fostering a supportive and dynamic learning atmosphere. By prioritizing engagement in collaborative settings, institutions can enhance students' academic performance, skill development, and overall educational experience, preparing them for future professional and intellectual endeavors.

These insights call for continued research on effective strategies for maximizing engagement in collaborative learning environments, ensuring long-term academic and personal growth for students.

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